

**Research Space**

PhD Thesis

**The teaching and assessment of the content and cognitive domains of two areas of physical activities for examined physical education**

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**The teaching and assessment  
of the content and cognitive domains  
of two areas of physical activities for examined  
physical education**

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## ABSTRACT

The introduction of assessments and examinations in Physical Education led to a shift from a recreational to an educational ideological base in the subject (Carroll, 1994). This resulted in the development of modes of assessment of the practical coursework for GCSE and 'A' level PE and Sport Studies that challenged the principles of validity and reliability of assessments. Further to this, teaching the content and cognitive domains (Bloom's taxonomy) of the practical coursework in the gym and class-based environments, as suggested by the examiners (MEG, 1993) still resulted in unsatisfactory learning outcomes. This led to a study which investigated the teaching of an athletic type and a game type activity to high school students (16-18) in three environments, practice-based classes (n=32), practice-based classes with discussions of a handout at the end of each session (n=27), and class-based sessions (n=38). The teachers' and pupils behaviours of the three experimental teaching units (ETUs) were analysed using the systematic observation technique CAFIAS. A second study examined the impact of the teaching environments on the assessment of the content (techniques, tactics and rules) and cognitive (knowledge and comprehension, application and analysis, and synthesis and evaluation) coursework of the two activities using an unseen written paper with diagrams and a video based unseen written paper.

The first study showed that the time spent on content emphasis was higher in the class-based ETUs, and that more time was spent on giving direction in the practice-based sessions. The class-based sessions provided more opportunities for teachers and students to communicate verbally. From the second study, ANOVA and MANOVA (repeated measures) procedures revealed statistically significant scores for all teaching environments ( $p < 0.05$ ) of both activities. However, the class-based athletic type activity yielded higher scores on the video based assessment for techniques, tactics, rules, knowledge and comprehension, and application and analysis, while evaluation was best assessed using the written paper to narrow the gap of gender inequalities in assessment. When the game type activity was taught in a practice-based class, the unseen written paper was found to yield higher scores for techniques, tactics, rules, and application and evaluation questions. Nevertheless, a practice-based class did not adequately prepare students for a video-based assessment in game type activities, except for the knowledge cognitive domain. The class-based, and practice and handout groups achieved statistically significant ( $p < 0.05$ ) better scores on techniques, tactics, rules, knowledge and evaluation questions of the video based papers. The findings of these studies are limited to the performance coursework of athletic type and game type activities of GCSE and 'A' Level PE and Sport Studies.

## DECLARATION

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## DEDICATION

I would like to dedicate this piece of work  
to my husband,  
Dr Wim van Vuuren,  
who has supported, inspired and enlightened me  
in the pursuit of academic research.

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## LIST OF ACRONYMS

'A' level:	Advanced Level
A 1:	Athletics: Physical Education -Practice-based Teaching
A 2:	Athletics: Physical Education Coursework - Practice-based Teaching and Handout
A 3:	Athletics: Sport-Studies - Class Based Sessions
AEB:	Associated Examining Board.
DFE:	Department for Education
EDEXCEL:	The Foundation for Educational Excellence (University of London)
EKSS:	End of Key Stage Statements
ETU(s):	Experimental Teaching Unit(s)
ETU 1:	Physical Education -Practice-based Teaching
ETU 2:	Physical Education Coursework - Practice-based Teaching and Handout
ETU 3:	Sport-Studies - Class Based Sessions
GCSE:	General Certificate of Secondary Education
GCE:	General Certificate of Education
GFU:	Games for understanding
HGPE:	Higher Grade Physical Education
KS Model:	Knowledge Structures Model
LEAG:	London Examinations and Assessment Group.
MATSEC:	The Matriculation Certificate Examination
MEG:	Midland Examining Group.
N 1	Netball: Physical Education -Practice-based Teaching
N 2:	Netball: Physical Education Coursework - Practice-based Teaching and Handout
N 3:	Netball: Sport-Studies - Class Based Sessions
NEAB:	Northern Examinations and Assessment Board.
NICCEA:	Northern Ireland Council for the Curriculum Examinations and Assessment.
OCEAC:	Oxford & Cambridge Examinations & Assessment Council.
OCR:	Oxford & Cambridge and RSA Examinations
OFSTED:	Office for Standards in Education
PE:	Physical Education
RT-PE:	Research on teaching in Physical Education
SEB:	Scottish Examining Board
SEC:	Secondary Education Certificate
SEG:	Southern Examination Group
SGPE:	Standard Grade Physical Education
SOW	Schemes of Work
TEPE:	Teachers of PE Project
ULEAC:	University of London Examinations and Assessment Council.
V.P.:	Video Based Unseen Written Paper
WJEC:	Welsh Joint Education Committee.
W.P.:	Unseen Written Paper

## CHAPTER 1

### INTRODUCTION AND BACKGROUND TO THE PROBLEM

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#### 1.1 Introduction

The introduction of assessments in Physical Education in England and Wales has resulted in a shift from a recreational to an educational ideological base in the subject. Knowledge of a theoretical nature such as sport science and social components was incorporated in the subject, while the practical performance coursework also underwent restructuring (Carroll, 1994). The development and justification of the content and modes of assessment of the theoretical and practical part of physical education have been argued and discussed by various authors (Alderson, 1988; Aylett, 1990; Carroll, 1990a, 1990b, 1994; Murphy, 1990; and Francis, 1990). The teaching and the mode of assessing the practical performance coursework, will be the focus of the ensuing discussion.

#### 1.2 Teaching the cognitive component of practical coursework in physical education.

The direction of the physical education curriculum is calling for instructional designs for teaching physical activities (Vickers, 1990), with a strong emphasis on metacognition (Luke and Hardy, 1999a), cognitive strategies (Luke and Hardy, 1999a), and cognitive abilities such as evaluation, application and analysis of performance (Carroll, 1994). What changes have teachers made to their teaching strategies to include these cognitive components in GCSE and 'A' level PE and Sport Studies? Have they included more specific teaching objectives? Have they considered, if not reverted, to classroom based teaching to vitalise this component? Which teaching resources are they using to teach the cognitive component of the performance coursework of GCSE and 'A' level PE and Sport Studies?

From the cognitive science perspective, knowledge has to be organised into a structure to be useful (Howard, 1987). A knowledge structure refers to a cognitive schema in which information can be cross-referenced and amended (Greeno, 1987). A teacher is expected to possess such a knowledge structure in which the subject content (concepts, principles, and skills) and pedagogical content knowledge (representations) are organised in an integrated manner.

The cognitive objectives of the National Curriculum: United Kingdom (DES, 1992, 1995), are found in the End of Key Stage Statements (EKSS) of all four stages, encompassing programmes for ages 6-16. The EKSS indicate that students are required to possess knowledge, describe, evaluate, understand, apply and analyse physical activity and exercise knowledge content. Thus, the EKSS include statements such as “devise and adapt strategies

and tactics.... and understand the short and long term effects of exercise.....” Key Stage 3 (age 11+ to 14) (DES, 1992, pg. 7-8). For Key Stage 4, which runs parallel to GCSE Physical Education route (age 14+ to 16) one finds statements such as “show increased knowledge in their selected activities ..... develop and apply their own criteria for judging performance ..... and prepare, carry out and monitor personal programmes for a healthy and enjoyable lifestyles” (DES, 1992, pg. 9b-10). Similar statements were also echoed in the statement of attainment targets in the end of key stage descriptions of the government’s response on the National Curriculum and its assessment (DFE, 1995, pg. 11-12).

These terms, as Carroll (1994) observed, can be linked to Bloom’s taxonomy of educational objectives - cognitive domain (Bloom, 1956) and to Peel’s level of understanding (Peel, 1971). Bloom’s (1956) and Bloom *et al.* (1971) hierarchical structure included six cognitive components, namely; knowledge, comprehension, application, analysis, synthesis, and evaluation.

Peel’s levels of understanding were organised into five categories: describer; explainer-understanding; what is required; cause and effect; and specific-general link. Bloom’s (1956) taxonomy was hierarchical and based on the premise that learners must acquire skills in incremental, sequential progressions with prerequisite skills being learned (mastered) prior to attempting more difficult and complex tasks (Metzler 1986). As Carroll (1994) noted, this hierarchy was not strictly adhered to as indeed, at Key Stage 2 (age 11) pupils were being asked to evaluate the performance of self and others, where evaluation was the highest (6<sup>th</sup>) level in Bloom’s hierarchy.

An examined course was aimed at enabling candidates to improve the cognitive and psychomotor abilities in relation to physical activities. At this stage it must be observed that the extent to which pupils at age 11 and 16 are expected to have reached the highest of the cognitive levels (evaluation), deserves closer examination. It is felt that the role of the lower cognitive levels of acquisition of knowledge and skills, comprehension and application need to be investigated as to whether they are indeed pre-requisites for the higher levels of analysis, synthesis and evaluation. Whether it is relevant and appropriate to require the mastery of higher cognitive skills at age 11 is not the scope of discussion in this study, however it is certainly an area that deserves inquiry.

The aims and assessment objectives of the practical coursework content of GCSE PE syllabuses (EDEXCEL, 1998a; MEG, 1998; NEAB, 1998a; NICCEA, 1998; SEG, 1998a; WJEC, 1998) required of teachers to teach pupils the subject-knowledge and performance of a

number (4-5) of physical activities and the cognitive skills of evaluating, analysing and improving performance of self and others. The subject-knowledge was physical activity specific and included the demonstration of performance of techniques, tactics, rules and umpiring. The pedagogical challenge of transforming these performance-cognitive skills into teachable content was originally exposed through the teaching of games for understanding approach (Bunker and Thorpe, 1982), which advocated integrating subject content of physical education with understanding. The understanding approach, necessitated of teachers to make the cognitive aspect of the learning experience more explicit by continuously challenging and stimulating learners to understand and articulate not just what they were doing, but also the reasons, meanings and explanations for their actions (Fleming, 1994).

It is interesting to know of the demands brought by this recommended change to the teaching environment given the required integration of subject-knowledge and cognitive components of practical coursework. It will also be of interest to know if the nature of activities pose particular demands on the teaching environment, for example, the analysis of a skill in gymnastics which requires a high degree of skill and safety precautions might not be possible to demonstrate in class but may be readily available on video. Power optimisation activities (athletic type) require a high degree of fitness levels for execution of performance, however the strategies/plan for the events can be discussed and evaluated away from the performance venues. On the other-hand game skills and tactics tend to be easier to demonstrate and hence analysis in the practical setting might be more relevant and appropriate.

The shift from recreational to educational PE required of teachers to be more focused and accountable for the integration of content and cognitive skills. The question at this point was; How were teachers integrating content knowledge (e.g. rules, techniques and tactics) of the activity together with cognitive abilities (e.g. knowledge recall, application, analysis and evaluation)? Did this require of teachers to go beyond the practical environment and adopt resources such as textbooks, videos, self-produced handouts and work sheets? Another important point of considerations was; Did the teaching of the different areas of content, such as, power optimisation (e.g. athletic types activities: swimming and athletics), movement replication (e.g. gymnastics and dance), and coincidence, anticipation and avoidance activities (e.g. game type: invasion, fielding and net games) lend themselves to a particular teaching context/environment for internalising cognitive abilities? Did these activities require a diverse dimension for a dynamic physical activity programme including content and cognitive components?

The content knowledge of the practical coursework at GCSE and 'A' level PE included a combination of the laws, rules, techniques, tactics, strategies, scoring systems, safety factors, umpiring and officiating. The areas of studies offered for the practical coursework of examined GCSE PE Syllabuses (EDEXCEL, 1998a; MEG, 1998; NEAB, 1998a; SEG, 1998a; SEG 1998b) were the same as those required for National Curriculum PE, however SEG did not offer area five. The six areas are (in alphabetical order):

1. Athletic activities
2. Dance
3. Games
4. Gymnastics
5. Outdoor and Adventurous Activities
6. Swimming

The NICCEA (1998) added another two categories Fitness Training and Games 2 while the WJEC (1998) categorised the practical activities offered for GCSE PE as follows:

1. Gymnastics or Dance
2. Competitive team games
3. Individual or pair activity

These structures required of a student to be competent in a variety of skills and physical activity orientations and thus contributed to a balanced programme.

The AEB (1999) PE 'A' level practical performance content was structured in two groups of activities: individual and games. Students were expected to choose one activity from each category.

Carroll (1994, pg. 80) classified the content knowledge of GCSE PE syllabuses in the United Kingdom under three categories:

1. Sports Science; covering anatomy, physiology, health related fitness, psychology of skill and physical basis of performance;
2. Social components include organisation and participation, contemporary issues in sport and physical education, and sport within society
3. Knowledge and Understanding of physical activities refer to rules, laws, techniques, tactics and anything else related to a specific activity.

The analysis of examined courses by Webster (1997) organised the areas of knowledge found in GCSE PE into four categories:

1. Human body make-up in relation to movement
2. Capabilities and limitations of the human body
3. Development and organisation of sport
4. Coursework [NEAB only]

Webster commented that these areas extended beyond the requirements of Key Stage 4 (age 16) National Curriculum in the United Kingdom. This statement supported Vickers' (1990)

assertion that little of this knowledge has been formally integrated into our schools and PE curricula as a universally acceptable body of knowledge. This statement, however does not hold true for GCSE PE, where this knowledge is very central in the syllabuses and student textbooks.

A closer analysis of three student textbooks recommended for GCSE PE (Beashel and Taylor, 1992; Bizley, 1996a, 1996b; Neate, 1996a, 1996b) revealed that there were four major categories covered in the textbooks: (i) Human body make-up in relation to movement; (2) Capabilities and limitations of the human body; (3) Development and organisation of sport; and (4) Coursework. Table 1.1 gives the number of pages and percentages allocated to each of the four categories. An analysis of the number of pages allocated to the various areas of knowledge is a first indication of the likely depth of knowledge and importance given to the respective components. What is interesting to note is that all three books included a substantial amount of tasks for students, and two provided a set of worksheets.

Table 1.1: A comparison of areas of study of textbooks for GCSE physical education

Area of Study Webster (1997)	Beashel and Taylor (1992) (2 <sup>nd</sup> Ed) 250 pages		Bizley (1996a) 181 pages		Neate (1996a) 153 pages	
	Pages	No of tasks	Pages	No of tasks	Pages	No of tasks
1. Human body make-up in relation to movement*	50 (20%)	46	26 (14%)	23	36 (23%)	43
2. Capabilities and limitations of the human body	91 (36%)	49	64 (35%)	68	61(40%)	91
3. Development and organisation of sport	109 (44%)	81	73 (40%)	73	46 (30%)	87
4. Coursework	0	0	19 (11%)	23	10 (7%)	23

From the total number of pages of the three books it was evident that Beashel and Taylor (1992) had more pages in total and for each category, however they did not include a section on practical coursework. The components related to “Human body make-up in relation to movement” covered 20%, 14% and 23% of the total content for each of the books respectively, with Bizley (1996a) including the least amount (14%). The fitness components under “Capabilities and limitations of the human body” included a range of between 35% - 40% across the three books. The category “Development and organisation of sport” was allocated a substantial amount (44%) by Beashel and Taylor (1992), which was closely followed by Bizley (1996a) at 40%. Neate (1996a) allocated a slightly lesser amount to this component (30%).

The “Coursework” component was simply not there in the case of Beashel and Taylor (1992), however it was evident in the more recent publications by Bizley (1996a) (11%); and Neate (1996a); (7%). The inclusion of tasks for students was also popular in these textbooks with as many as 176 from Beashel and Taylor (1992); 187 tasks in the student’s textbook and separate photocopyable handouts in Bizley (1996a, 1996b); and 224 tasks in the textbook and separate photocopyable handouts in Neate (1996a, 1996b). The relatively low coverage of practical coursework in textbooks is evident and somewhat of concern given that it accounts for 60%-70% (Webster, 1997) of the total grade for GCSE PE. Further details of the content of the four categories are found in appendix 1.1.

The tasks assigned in these textbooks were directly related to the content of the topic, (e.g. acquisition of skill), however there were some tasks referring to the practical coursework content for example:

“Can you tell which one of the swimmers shown in the two photographs is more skilful? If you can, how do you know?” (Neate, 1996a, pg. 16).

“Imagine you are a coach for a team. On a sheet of paper, draw out the positions for all the players for a set play tactic. Describe how the tactic should work” (Bizley, 1996a, pg. 9)

A more recent textbook for GCSE PE by Hodgson (1998a, 1998b) covered the same four areas of study as the other three textbooks, however there is a section on “Sport business and finance” as a sub-category of the development and the organisation of sport. The last chapter of this book was entitled “Practical Activities” (pg. 287-301) and included generic sections on classification of activities, principles of physical activities and assessment. More physical activities and “areas of National Curriculum activities” were expected to be covered in this publication given the emphasis on analysing self and others that became a central part of National Curriculum and GCSE PE at the time of publication. This book also included tasks in the form of activities along each chapter, while at the end of each sub-section of the chapters there was a set of general questions and exam style questions. An example of one of the three exam style questions taken from the practical performance coursework section is given below:

- “1. In an invasion game of your choice:
    - a. State two rules about foul play and the decision a referee makes (4 marks)
    - b. Describe a team formation and three players who are involved ( 6 marks)”
- (Hodgson, 1998a, pg. 301)

Hodgson (1998b) also included a teacher’s pack of photocopyable worksheets. The utilisation of student textbooks was the norm for GCSE and ‘A’ level PE courses in the United Kingdom, however there isn’t any evidence on the actual use of teacher’s reference books, student textbooks, videos, CD-ROMs, software and technological equipment for fitness

measurement. It will be of interest to know which publications and other teaching resources are used for the practical coursework and the strengths and limitations of the current resources for preparing students for the performance and cognitive component of GCSE and 'A' level PE. However, from PE teaching resources catalogues and publications one can observe that the 1990s are experiencing a substantial increase of educational publications for use in PE (Hennesy, 1996; Roscoe, 1998). Hennesy (1996) produced a reference book providing comprehensive listings of practical resources such as instructional materials, students' texts, videos, supplementary music, equipment manufacturers, publishers and sport organisations. Roscoe (1998) publications catalogue listed textbooks, videos and CD-ROM publications to be used in conjunction with teaching the theory and performance coursework of GCSE and 'A' level PE and Sport Studies. However, little do we know about the use of these teaching resources for the practical coursework.

Roscoe (1998) also reviewed various series publications such as "Know the Game Series" (KTG), "The Skill of the Game Series", "Steps to Success Series", etc. These sports activity specific books tend to be of an informative and generic nature and include either, or a combination of rules, skills, tactics and umpiring. The (KTG) was regarded suitable for the general reader and the first two years of secondary school. Other series were described as more focused in character, whereby skills and tactics were central. This was prevalent in "The Skills of the Game Series". A series recommended for more advanced classes, such as GCSE and 'A' level PE, was the "Steps to Success Series", which in most cases included teachers and student's textbooks for each sport activity. This series also included tasks assigned at the end of each topic. Some of these books focused on skills and tactics and excluded rules and officiating altogether. Training methods and analysis, correction of faults and improvement of performance were not covered in adequate detail for the purpose of GCSE physical activities in the publications in circulation with the exception of the "'A' Level Athletics" pack (Roscoe, 1996). The fact that the content of these publications does not address the requirements of GCSE and 'A' level PE coursework makes it problematic for teachers to assign a textbook for the physical activities. What is of more immediate concern is the absence of practical coursework and sport specific textbooks and teaching resources that address cognitive components such as the analysis, evaluation and improvement of performance.

The effectiveness of teaching in PE has been measured through Academic –Learning–Time in Physical Education: ALT-PE (Siedentop *et al.*, 1982) while what goes on during the PE class has been described through systematic observation techniques such as Cheffers Adaptation of Flanders Interaction Analysis System: CAFIAS (Cheffers and Mancini, 1989) and the Qualitative Teachers Performance Research Scales: QTPRS (Rink and Werner, 1989). The

application of the systematic observation instruments to classes offering GCSE and 'A' level PE courses would be of interest to PE teachers since teacher-pupil interaction, engagement time, identification of the teaching environment and the impact of the teaching context (gym, class or a combination of both), can be quantified. Can outcomes be measured in terms of engagement time? If teachers decide to allocate sessions to "theoretical" class-based sessions to teach certain components of the practical coursework, is that going to change the quality of experience of the students? Is a change in the teaching context (gym/ class) going to contribute to better learning outcomes given the practical performance and the paper and pen mode of assessments?

The challenge of teaching GCSE and 'A' level PE is demanding, since traditionally PE was regarded as a practical subject with no academic or theoretical work (Carroll, 1982). Many teachers, however, did believe that there was a large body of knowledge related to the basis of physical performance (anatomy and physiology), knowledge related to specific activities (rules, tactics, techniques of skills, scoring systems) and knowledge related to access to participation in physical activities and sports (social issues and facilities). Carroll (1991) also noted that in GCSE syllabuses, analysis and evaluation of the practical content were limited in their appearance and examples were often hard to find. This left teachers to struggle their way around becoming effective in teaching an examined course in physical education.

The terms effective teaching and good teaching have often been used interchangeably, however effective teaching is used to describe teaching that results into learning (Berliner, 1987; Brophy, 1979; Rosenshine, 1987). Other terminology related to effective teaching is teaching skills and competencies (DFE, 1992) and aspects of "quality" teaching (OFSTED, 1993). Mawer (1995) looked at the professional and research views defining effective teaching in PE. The descriptive studies using systematic observation systems identified the teacher and pupil behaviour during the lesson. This research helped define what was going on in the classroom but was not able to offer any suggestions concerning the characteristics of effective teaching. The most important and probably the most relevant teacher effectiveness research findings concerning subject matter, resulted from studies designed to assess the relationship between process variables (what teachers and pupils do in the classroom) and product or outcome variables (changes in pupil knowledge, skills, values related to instructional goals) (Mawer, 1995). In this approach, a teacher's pattern of interaction and the associated pupil process variables were correlated with high levels of pupil learning, establishing teacher processes that were more effective for pupil learning.

### 1.3 Chief examiners' perspective on the teaching of practical coursework

The practical coursework content of GCSE and 'A' level PE required teachers to include performance of techniques, tactics, rules and umpiring of a number of practical activities as well as teaching the knowledge, application, analytic and evaluative skills related to improved performance (EDEXCEL, 1998a; MEG, 1998; NEAB, 1998a; NICCEA, 1998; SEG, 1998b; WJEC, 1998; AEB, 1997a, 1998a; OCEAC, 1997). The observation and analysis component of physical activities still needed teaching refinement and rethinking as pointed out by the examiners' report:

“Centres need to be aware that, although they may be specialist in particular areas of the theoretical aspects of the course, a sound working knowledge of **all** areas will enable synthesis of **all** aspects of the theory to practice when conducting the observation analysis connections and synthesis assessment. This will be essential for the 1998 assessment”  
(AEB, 1997b, pg. 17)

This comment raised the issue of the need for teachers to apply aspects of sport science and social science domains to the practical performance context. Examiners felt that they should take a liberty in suggesting what teachers should do too:

“with next year's split for analysis/ correction/ synthesis, it is imperative that centres allow candidates as much practice time as possible. Preparing candidates in groups is good practice, serving to reduce pressure on individuals. However, final assessments must be of a candidate's individual performance.”  
(AEB, 1997b, pg. 18)

At GCSE level examiners have regularly expressed their scepticism with regards to the teaching of the subject content matter with reference to the practical activities. Examiners' reports have come up with statements such as “a good depth of theoretical knowledge was often shown to be lacking” (SEG, 1991, pg. 2) and that candidates “confused technique with rules or style of play” (SEG, 1994, pg. 4). It is worrying to read that “questions requiring knowledge and understanding of specific terminology indicated that many candidates were not acquainted with the terms” (ULEAC, 1994, pg. 6) and that “umpire's signals were known only to a few candidates” (ULEAC, 1995a, pg. 5). In another case it was noted that candidates still use incorrect terminology such as “foul” instead of “fault” in racket games, “throw up” in place of “toss up” in netball, and “jumpball” in Basketball (ULEAC, 1995a, pg. 4).

Other comments reported by the examiners with reference to questions on physical activities lead one to reflect on how the kind of content knowledge and cognitive abilities found to be weak amongst candidates could be remedied. Candidates' weaknesses to read and understand the questions have been regularly cited as a crucial point. For example, a question requiring students to give a “game plan” turned out to be confusing with candidates concentrating on team formations, set plays and tactics (SEG, 1995, pg. 4). Similarly, when candidates were

asked to name an individual skill of an activity, some referred to “set plays” or “tactical moves” rather than the skill aspect (SEG, 1996a, pg. 2).

The comments of the examiners' reports leads one to question the quality of teaching effectiveness in terms of the process-product dimension and whether there is room for improvement such that learning can be documented with valid modes of assessments.

#### **1.4 Examining the cognitive component of practical coursework in physical education.**

Carroll (1990a, 1991) summed up the objectives assessed in GCSE PE in the United Kingdom in three domains namely: performance, knowledge and understanding, and analysis and evaluation. An analysis of the assessment objectives for the 1998-1999 syllabuses of GCSE PE revealed that the following statements have been adopted by all the examining boards in an attempt to standardise the assessments of the candidate's ability to demonstrate:

1. “Physical performance, including the ability to interrelate planning, performance and evaluating whilst undertaking activity;
2. Analysis of improvement of their own and others performance;
3. Knowledge and understanding of
  - 3.1. the factors affecting performance;
  - 3.2. the health and safety aspects of physical activity, including the advantages and risks associated with a range of training strategies and techniques; and
  - 3.3. the reasons for participating in physical activity.”

(EDEXCEL, 1998a; MEG, 1998; NEAB, 1998a; NICCEA, 1998; SEG, 1998a; WJEC, 1998)

The first two assessment objectives had a direct impact on the practical coursework. The second objective included a new cognitive dimension: application of improvement of performance. The major change in the assessment of the practical coursework component has occurred in the assessment of the knowledge, understanding and cognitive component with the removal of unseen written papers by the majority of the examining boards (EDEXCEL, 1998a; MEG, 1998; NEAB, 1998a; NICCEA, 1998; SEG, 1998a; WJEC, 1998). This implied that teachers needed to assess this component for each or some of the 4-5 activities using the examining boards' guidelines and self made assessments in the form of school based oral assessments and written activities as will be discussed in detail in chapter two. The fact that mark weighting was allocated to the knowledge, understanding and cognitive component of practical activities was an improvement but the mode of assessment suggested required consideration in terms of validity, reliability and consistency. The assessment was based on the teacher's observation skills, ability to interpret and apply the assessment criteria issued by the examining boards, and the student's opportunities to “apply” rules, tactics, techniques and umpiring, and “comment” on the improvement of performance.

An item ever present in examined syllabuses is assessment objectives. These indicate more specifically the skills and abilities which were to be assessed (Webster, 1997) and provided the percentage mark weighting for every knowledge component and the mode of assessment. An analysis of these assessment objectives schemes and the relevant assessment modes used to examine the knowledge, understanding and cognitive component of the practical activities of GCSE PE (1994-1997) revealed that the amount of activities and the modes adopted for assessment was distinct for every examining board. Although all GCSE examining boards required students to take 4 or 5 practical activities for the practical performance assessment, it was evident that not all of these 4-5 activities were examined for the knowledge, understanding and cognitive abilities, as demonstrated in table 1.2:

Table 1.2: Examining the Knowledge, Understanding and Cognitive components of practical activities of GCSE Physical Education (1994-1997)

EXAMINING BOARD	<i>Number of practical activities for the practical performance assessment</i>	<i>Number of practical activities for the cognitive assessment</i>	<i>Mode of assessment</i>
MEG: GCSE	4	Pathway 1: 1 or 2 practical activities from 12	Part of unseen written paper
		Pathway 2:	Two physical activities and one assignment
		Pathway 3:	Two assignments
NEAB: GCSE	4	4 practical activities	Assessed in the practical situation by the teacher.
NICCEA: GCSE	4	3 Assignments: 1. Analysis of performance 2. History and rules of the 4 activities taken in practical 3. Essay on one or more of chosen practical activities	3 Assignments
SEG: GCSE	5	Refer to any of 18 physical activities to answer a series of general questions	Part of unseen written paper. Paper 2
		Compulsory for extended paper: Refer to any of 12 physical activities to answer a series of general questions	Part of unseen written paper Papers 2 and 3
ULEAC: GCSE	5	4 Physical Activities	Unseen written paper
WJEC: GCSE	4	Dance / Gymnastics	Unseen written paper (following the viewing of a video performance)
		Refer to 1 team game from five	Part of unseen written paper
AEB 'A' Level	2	Two practical activities	Unseen written Paper

The assessment of the practical performance component for GCSE included the performance assessment of 4-5 physical activities. The activities which candidates selected for the practical performance were not all assessed and examined for the knowledge, application and evaluation domain (Cassar, 1995). Two physical activities from four were examined in the case of MEG and WJEC. ULEAC required five practical activities for the performance assessment and four for the knowledge, understanding and cognitive. The knowledge, application and evaluation of techniques of skills, tactics and rules of as little as 2 physical activities (MEG, 1993; WJEC, 1996) and at most 5 physical activities (SEG 1997a) were assessed through the use of unseen written papers (Cassar, 1995).

MEG, ULEAC and WJEC required candidates to select some of the physical activities they had been prepared for and to answer a series of sport specific questions. SEG required of candidates to refer to a physical activity when answering generic questions related to a group of activities. Presenting situations from practical activities on video, as happens to be the case of the WJEC, or by the use of diagrams, as is the case of the unseen written papers, would be considered a valid mode of assessment. However we do not know whether candidates were in a better position to answer questions related to a practical activity if they were exposed to a visual image such as a life demonstration or a video clip or a diagram. Whether students answered in writing or orally is also central to the question of reliability and validity.

NEAB had the cognitive component assessed in the practical setting together with the performance assessment. With regards to this form of assessment, Carroll (1994) raised the question of whether knowledge and understanding of performance should be assessed through physical activities. Giving a mark on a student's knowledge of the tactics of a game by assessing, for example how a pupil applied tactics in a number of competitive games, against a variety of opposition or playing a variety of styles of that game, does not give the child the opportunity to show the knowledge, understanding and skill that has been mastered. Carroll (1994) further suggests that the knowledge and understanding components should be kept separate from those relating to performance.

Carroll (1982, 1994) also noted that what was particularly interesting was that the knowledge base, which could be taught in the practical setting, was often taught in a traditional manner using chalk and talk. This could be explained by the fact that until the sitting of 1997, the assessment of the cognitive domains associated with the practical components had been assessed using unseen written papers by the ULEAC, SEG, MEG and AEB Boards. The project work in the case of NEAB, and video-analysis of performance in the case of the WJEC required students to analyse and evaluate at greater depths.

The mode of assessing the knowledge, application and evaluation components of physical activities until the summer sitting of 1997 varied from one examining board to the other. The diversity of testing techniques ranged from observation and assessment during the practical session by the teacher, unseen written papers, to assignments and video analysis. This has changed for the sittings of 1998-1999, as all practical activities were assessed for observation, analysis and synthesis. An additional component, ‘improvement of performance of self and others’ had been incorporated in the analysis domain (EDEXCEL, 1998a; MEG, 1998; NEAB, 1998a; NICCEA, 1998; SEG, 1998b; WJEC, 1998; AEB, 1997a, 1998a; OCEAC, 1997). This change was coupled with further modifications to testing techniques, namely the removal of unseen written papers for assessing and examining the practical performance coursework by all examining boards but one (WJEC, 1998). This change called for an analysis of the validity and reliability of the various modes of assessment adopted to examine the knowledge and understanding components of practical activities.

At ‘A’ level, candidates taking PE or Sport Studies in 1998-1999, sat for the same two unseen written papers accounting for 70% of the total grade. The remaining 30% were allocated to practical coursework, in the case of PE, and to a written project in the case of Sport Studies (AEB, 1998a). The physical activity specific unseen written papers of the practical performance assessment of ‘A’ level PE were in use for 3 sittings of the summers of 1995-1997. These have been withdrawn from the assessment structures of 1998. The candidate’s

“ability to demonstrate understanding of specific skills and techniques will be assessed through personal demonstration, observation and analysis, identification and correction of faults and synthesis of theory and practical.”

(AEB, 1998a, pg. 34.)

Teachers were further instructed that “questions posed should be open-ended, thereby giving candidates the opportunity of expressing their depth of knowledge and understanding of the activity...” (AEB, 1998a, pg. 35).

The introduction of GCSE half courses for 1997, and the addition of GCSE Physical Education: Games (full and half course) have added to the options available to suit teachers’ expertise and school facilities. The courses offered by the various examining boards is illustrated in the table 1.3

Table 1.3: The Four types of GCSE examinations and their syllabus reference number

Examining Board	<i>Physical Education (full course)</i>	<i>Physical Education: Games (full course)</i>	<i>Physical Education (short course)</i>	<i>Physical Education: Games (short course)</i>
<b>ULEAC (EDEXCEL)</b>	1825	1826	3825	3826
<b>SEG</b>	2680	2685	Not offered	1485
<b>MEG (OCR)</b>	1680	1681	Not offered	3680
<b>NEAB</b>	1271	Not offered	2271	Not offered
<b>NICCEA</b>	Offered: No code number	Not offered	Not offered	Not offered

Examining Board	<i>Physical Education (full course)</i>	<i>Physical Education: Games (full course)</i>	<i>Physical Education (short course)</i>	<i>Physical Education: Games (short course)</i>
<b>WJEC</b>	Offered: No code number	Not offered	No code number <sup>1</sup>	Not offered

(Webster, 1997, pg. 2)

<sup>1</sup> First offered in 1998 and not acknowledged in Webster (1997)

The main differences between the Physical Education and Physical Education (Games) syllabuses lay in the classification of the areas of physical activities for the performance coursework. The Physical Education syllabuses drew on the six areas of activities of the National Curriculum whereas the Physical Education (Games) syllabuses included a classification of game activities (net/wall, striking/fielding/target, and invasion). The contrast between the full and half courses related to the number of physical activities expected to be offered for the course, with two for the half courses and 4-5 for the full courses. The theoretical subject content was also reduced for the half courses.

These options have also added to the complexity of the problems related to adherence to National Minimum Curriculum requirements and standardisation of assessments. For the purpose of this study reference will be made only to GCSE: PE full course syllabuses and to GCE: Advanced level PE and Sport Studies syllabuses.

The practical coursework remains a central part of GCSE PE. An analysis of the new direction of practical coursework assessment is given in table 1.4. This shows that the practical performance assessment has absorbed the assessment of the knowledge, understanding and cognitive component, while a new component, termed “analytic investigation” has been introduced.

Table 1.4: The % mark allocated to the practical coursework component

Assessment objectives and scheme of assessment	Examining Board 1998-1999						
	NEAB	SEG	MEG (OCR)	EDEXCEL	NISEAC	WJEC	AEB
Physical performance including an ability to interrelate planning, performance and evaluating whilst undertaking activity	50%	48%	50%	50%	50%	50%	25%
Analysis and improvement of their own and others' performance	20%	12%	10%	10%	10%	10%	
Demonstrate orally and in writing, knowledge and understanding of the practical concepts underlying sport performance: observation, correction and synthesis of 2 activities	0%	0%	0%	0%	0%	0%	5%

Assessment objectives and scheme of assessment	Examining Board 1998-1999						
	NEAB	SEG	MEG (OCR)	EDEXCEL	NISEAC	WJEC	AEB
Team games Part of unseen written paper: question on one activity	0%	0%	0%	0%	0%	9%	0%
Gymnastics or Dance Unseen written paper with video	0%	0%	0%	0%	0%	10%	0%
TOTAL Mark: Practical Coursework	<b>70%</b>	<b>60%</b>	<b>60%</b>	<b>60%</b>	<b>60%</b>	<b>79%</b>	<b>30%</b>

The change has brought about a shift of more marks in favour of the practical coursework component from 40-60% (Cassar, 1995) to 60-79% in the case of GCSEs, however 'A' level PE retained the same weight of 30%. The performance, planning and evaluation assessment was allocated 48-50% across all examining boards at GCSE and 25% at 'A' level. The analysis and improvement of performance was allocated 10-20% of the total mark. The only examining board utilising unseen written papers is the WJEC, with a weighting of 19%. The examining boards have issued different depths of detailed criteria for the assessment of the practical performance, however, the validity and reliability of this assessment through "observation and interpretation" of the teacher remains a very questionable subject for those who would like to adhere to sound practices of educational measurement. The reliance on teacher's observation and interpretation of skills and abilities, and the use of oral not necessarily recorded assessments raises cause for concern for the validity and reliability of the these modes of assessment.

## 1.5 Statement of the research problems

### 1.5.1 *Teaching the cognitive component of practical coursework in physical education*

The teaching of the cognitive component of the practical coursework in PE has presented a challenge to teachers as the integration of the practical coursework and the "cognitive" assessment objectives of examined courses in PE have become problematic areas as noted in the examiners' reports. It is therefore of interest to investigate which teaching materials and environments (class, gym or both) contribute more to effective teaching of the cognitive component. The possible impact of the content of physical activities from different families/classifications of activities, is also a source meriting investigation in relation to possibly different teaching strategies, environments and resources. The problem of teaching the cognitive component of the practical coursework is twofold. The first concern is directed towards the changes (if any) teachers are required to make to the teaching environment to achieve learning outcomes. The second is more specifically related to the methods of teaching the cognitive skills

namely knowledge, application, analysis of performance and evaluation, which GCSE and 'A' level PE, has brought to the forefront.

### ***1.5.2 Assessing the cognitive component of practical coursework in physical education***

The classification of the physical activities offered for GCSE and 'A' level PE included movement replication activities (gymnastic type: gymnastics and dance), power optimisation activities (athletic type: athletics and swimming), coincidence, anticipation and avoidance activities (game type) and adventure activities. The methods of examining the cognitive components of these activities (knowledge recall, application of techniques, rules and tactics, analysis and evaluation of performance) over the past few years included unseen written papers, video based unseen written papers, oral assessments, assessments in the practical setting, assignments and project work. Teaching and examining the subject content knowledge and the cognitive components of these different activities needs to be investigated in the light of using modes and methods of assessment which are valid, reliable, clear and include a balanced variety of situations of the physical activities *per se*. The change from unseen written papers to oral assessments in 1998 led one to question why the latter were regarded as more valid and reliable? Also, how did candidates feel about these different modes of assessments? The problem of examining the cognitive component of practical coursework has three central issues. Firstly, are there more valid methods of assessing cognitive components? Secondly, are there cognitive components that lend themselves to particular modes of assessments such that these will rate higher on validity? Finally, do the cognitive components of physical activities from the different families/classifications require to be assessed using particular modes of assessment?

This complex teaching/(process) – assessment/(product) situation lends itself to an inquiry of the teaching environments (class, gym or both) for teaching the cognitive components of physical activities from different classifications of activities. The teaching and assessment of two physical activities from each of two classifications of activities: power optimisation (athletics) and coincidence, anticipation and avoidance (netball) will be studied and investigated through experimental teaching units (ETUs) in the hope of identifying more or less effective teaching environments for delivering the cognitive components. The assessment of the cognitive component will also be examined using different modes, in an attempt to identify the more valid and reliable methods of assessments for the different cognitive skills of physical activities from different classifications of activities.

## CHAPTER 2

### REVIEW OF LITERATURE

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#### 2.1 Introduction

The first part of this chapter will focus on research on teaching PE in an attempt to identify the current research trends and criticisms of this field. Processes and instruments used to gauge teacher effectiveness in PE will be discussed in an attempt to identify characteristics deemed more or less effective. The contribution of pedagogical studies to the field of teaching PE will also be reviewed. This will be followed by a review of studies on experimental teaching units of various physical activities.

Teaching models such as the Knowledge-Structures model (Vickers, 1990) and the “games for understanding” model (Bunker and Thorpe, 1982; Werner and Almond 1990, Werner *et al.*, 1996), will be critically analysed with reference to their potential contribution to teaching practical coursework for examined PE.

The second part of this chapter will centre on the modes of assessment of the practical coursework component of PE. Theoretical frameworks linking teaching, learning and assessment will be discussed. The structure of the classifications of physical activities of practical coursework will be reviewed and the modes of assessments used for the different physical activities in GCSE and ‘A’ level courses in PE will be analysed with reference to the principles of validity and reliability of educational measurement theories. Finally, the teaching and assessment of the cognitive component of PE will be combined in a process-product dimension and the problematic areas warranting investigation will be identified.

For this review, physical education, psychology and educational measurement journals, books, dissertations and theses have been reviewed, including those resulting from keyword searches on the following CD Roms: Sports Discus, ERIC, Psyclit., ASLIB dissertation abstracts.

#### PART 1

##### Teaching of the practical coursework in physical education

#### 2.2 Research on Teaching in Physical Education [RT-PE]

The field of RT-PE began in the 1940s in an attempt to identify teacher qualities or pressage variables (e.g. social class of parents, number of siblings) that would correlate with teacher effectiveness or product variables (Lee, 1991). It has been commented that research on pressage variables has been disappointing and has provided few results of practical importance to the

teacher. According to Bloom (1979), teacher characteristics rarely explain more than 5% of the variance of student achievement. Under the “characteristics of the teacher” one finds psychological traits and physical fitness variables.

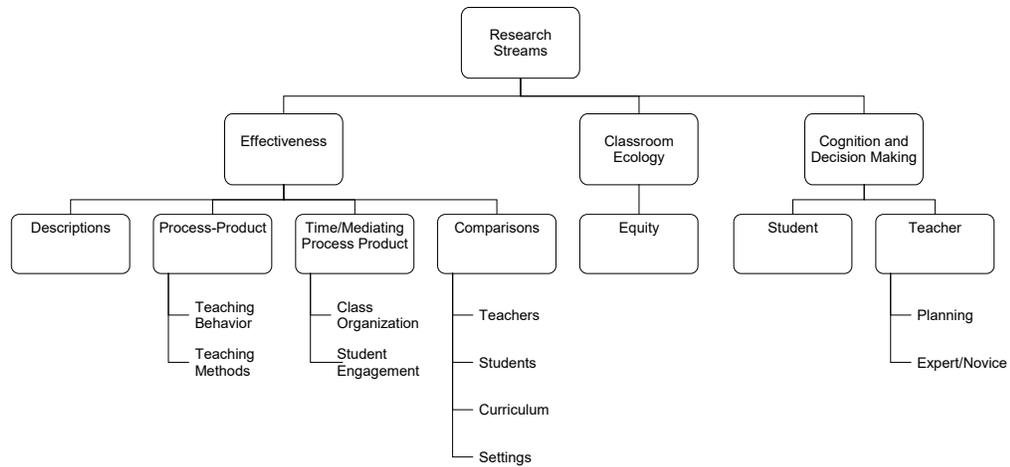
Later studies were concerned with the identification of strategies which facilitated the acquisition of motor skills, for example, comparing two methods of teaching basketball for beginners (Whilden, 1956). Nixon and Locke (1973) reviewed research in PE that was mostly related to improving skill practice. They called for more descriptive and analytic research in motor skill learning, where methods for the systematic recording of events and behaviours could be designed and examined. So far, the research helped physical educationalists to understand what teachers and pupils did in the PE lesson but was unable to offer conclusive suggestions concerning the characteristics of effective teachers (Mawer, 1995). During the 1970s, interest in systematic observation of teachers and events in practical classes of PE led to the development of a number of instruments to collect and describe quantitative data on teaching. In the early 1970s pedagogical researchers started considering observational instruments for classroom observation (Lee, 1996). Dunkin and Biddle (1974) modified and adapted a model described by Mitzel (1960), that organised variables into four categories:

- Passage variables: (characteristics of the teacher)
- Context variables: (condition to which the teacher must adjust)
- Process variables: (teacher and student activities in the class)
- Product variables: (teaching outcomes)

Piéron (1994), presented a broad survey of the research completed on instruction in PE classes and he considered the following paradigms and research techniques: process-product, the qualitative approach, the mediating process, cognitive techniques and correlational and comparative approaches. He commented that the main research problems which still needed to be addressed included the impact of high inference teaching qualities (enthusiasm, clarity, class management), discipline and burnout problems, teacher decision-making in pre-active and interactive phases during teaching, and the appropriateness of teacher intervention and student engagement.

Silverman (1991) reviewed RT-PE covering a period of fifteen years. He classified RT-PE into three streams, namely instructional effectiveness, classroom ecology, and cognition and decision-making. Branches of these categories are illustrated in figure 2.1:

Figure 2.1: RT-PE research streams.



(Silverman, 1991: pg. 353.)

Silverman (1991, pg. 352) defined the parameters of this classification as “research on what teachers and students do and how this affects or relates to learning and to the social dynamics of the class”. His rationale for the selection of these streams stemmed from a historical perspective. He referred to the early research reviews by Nixon and Locke (1973) as an area closely resembling research on motor learning and he emphasised the move away from the dependence on motor learning models. The application of motor learning research has been described as having a weak design and that instruction was rarely monitored or verified. Lee (1991) feels that research programmes in the fields of motor learning, and all areas of teaching developed in similar ways have suffered from the same contradictions and negative findings. Firstly, there was a failure to generate consistent evidence. Secondly, a deficiency was the failure to seek reasons why a particular method or practice schedule worked.

The effectiveness stream included four sub-groups: descriptions, process-product, research on the relationship of time and mediation (student practice variables to achievement), and comparisons. Lee (1991) commented that there was little discussion on how the description of behaviour and actions served as a measure of teacher effectiveness. The definitions of effectiveness offered in the literature should offer conceptual alternatives and as Doyle (1977) suggested, effective formulations should include both contextual variables and the meanings teachers and students assign to events and processes during instruction. According to Doyle, the question related to instructional effects should be “how do students learn from teaching?” as well as “what kind of teaching causes learning?”. In classroom teaching research, however, it has been reported that classroom teachers misinterpret their own teaching behaviours and that teachers themselves were unable to describe accurately even simple behaviours such as percentages of time that they and their students spent talking (Piéron and Cheffers, 1988). Good and Brophy

(1991) also reported that most teachers grossly underestimated the amount of time they talked. Another important element in teaching was the inter-individual variability for teaching (Rink, 1983). She reported on three evolutionary trends for teaching behaviours in PE:

1. Stable behaviours, remaining at the same level throughout the whole teaching unit; that is behaviours related to organisation and management of the class and student behaviour.
2. Unstable behaviours: related with lesson beginning time and communication of content.
3. Behaviours tending to change in the same direction over the unit: allocated time for practice increased from beginning to the end. This trend was not completely explained by increased game-like play. The use of questioning decreased as the teaching unit progressed.

The issues expressed above render descriptive studies on teaching PE questionable.

Lee (1991) also noted that the process-product paradigm linking student behaviour to teacher achievement produced few research-based conclusions about teachers that maximise student achievement. During the 1980s process-product and experimental teaching studies were conducted in PE (Lee, 1996). Experimental research has failed to substantiate a superior method of teaching physical education, a single, reliable, multi-purpose teaching strategy that can be called “The Best Approach” (Piéron and Cheffer 1988 pg. 6). Nevertheless, process-product research provided specific teaching behaviours associated with student achievement (Boyce, 1992, pg. 389-390):

- a. high percentage of class time devoted to content
- b. appropriate and considerable practice
- c. successful practice
- d. high expectations of students
- e. minimal waiting time, transition and management time
- f. student accountability
- g. supportive learning environment
- h. direct instruction (task oriented, clear statement of goals, demonstration and explanation of task, teacher controlled, closely monitored, immediate and task-related feedback).

In physical education classroom research, full-scale process-product studies have been substituted with Experimental Teaching Unit(s) (ETU(s)) (Piéron and Graham, 1986). The ETU provides a small-scale process-product setting. Graham (1983) defined an ETU as a brief series of lessons on a topic that is of general interest to the grade level of students to be taught by the teachers in the experiment. In ETU studies, the learning environment was reduced in terms of time, space, and number of students. ETUs were characterised by four factors (Piéron, 1994, pg. 79):

1. A learning objective is set forth for all teachers involved in the study.
2. A measure of student learning is developed specifically to measure the instructional content taught in the ETU, which is administered before and after the actual ETU lesson(s) are taught. Fitness tests and questionnaires may be administered. Interviews also yield insight into students’ responses and perceptions of the activities and the subject matter taught.
3. A relatively short teaching period is of specified length.
4. Systematic observations of selected teacher and student behaviours are conducted during the actual ETU lesson(s).

Tasks which have been taught and studied using ETU content included; the cartwheel in gymnastics: (Yerg 1981a, 1981b), the handstand roundoff and back handspring (Piéron, 1983), a novel golf swing (Metzler, 1983; Salter and Graham, 1985), the forehand and backhand and service in tennis (De Knop, 1986), and volleyball skills (Philips and Carlisle, 1983). The length of the unit varied from a 15 minute lesson (Yerg and Twardy, 1982) to 15 hours of instruction over a series of lessons in the study of tennis teaching (De Knop, 1986). Apart from studies directed at teaching physical activities, there were studies comparing teachers' behaviours (Rink *et al.*, 1986), teaching modes/styles (Salter and Graham, 1985; Turner and Martinek, 1995a; Mitchell *et al.*, 1994; Mitchell, 1996, Harrison *et al.*, 1999), teaching modes for specific content domains of physical activities (French and Thomas, 1987 (basketball); McPherson and Thomas, 1989 (tennis); Turner and Martinek, 1999 (field hockey)) and student engagement variables (Silverman, 1991).

One study compared the effects of different teachers over a 15-lesson volleyball unit of instruction on 7<sup>th</sup> and 8<sup>th</sup> grade (age 12-13) intact classes (Rink *et al.*, 1986) with reference to psychomotor, affective and cognitive outcomes. This study revealed that all subjects made improvements from pre-test to post-test on psychomotor skills (serve, overhead pass and forearm pass) with a significant effect for skill level with low and high achievers making the least progress in the serve. The cognitive variables included knowledge of rules, mechanics and strategies. The improvement from pre-test to post-test was significant in the cognitive dimensions of rules and mechanics but not in strategy. The skill level of the subjects was not a factor effecting cognitive outcome and no significant differences between the subjects' skill levels (low, medium and high) existed in the cognitive post-test, either because psychomotor learning in this context had little relationship or the test was not sensitive to changes in cognitive learning (Rink *et al.*, 1986).

The improvement of learner performance reported conflicting results. In a study by Metzler (1983), who used a control group who practised a criterion task without the direction of the teacher, the learning gains of the control group who practised on their own for 20 minutes was virtually identical to the group that received 20 minutes of instruction. This finding was replicated in a similar study by Salter and Graham (1985), however it has been explained by the authors that the students in the control group (no instruction) had significantly more skill practice ( $m=29.56$ ) attempts than students in either the Command ( $m=18.56$ ) or the Guided Discovery ( $m=20.63$ ) groups.

The time/mediation process-product of Silverman's (1991) classification stream has been approached by relating time and student engagement variables to achievement. Doyle (1977)

criticised this time utilisation criteria, claiming that the use of overt, observable variables such as time utilisation and task completion rates were limited because these “reflect a preference for overt manifestations of student mediation processes” (pg. 175) and, although useful, were gross measures of information-processing procedure. Piéron (1994) stated that although many studies showed that time on task was important in student learning and was related to achievement in PE, the number of practice trials and the difficulty levels were more important than engagement time. The quality of student engagement was so important that the formula “busy, happy and good” (Placek, 1983) could not promise significant progress in student achievement. Lee (1991) added that a thorough understanding of how learning occurred from teaching would require defining more precisely the student variables that might affect the quality of student engagement. It would be necessary to extend the time-mediation approach to include the covert responses operating and the study of motivational, affective, and cognitive aspects of student thinking during instruction. She strongly suggested linking the process-product approach to classroom ecology and the cognition and decision-making.

The research streams formulated by Silverman (1991) were reviewed with strong scepticism (Lee, 1991; Dodds and Placek, 1991; Goldberger 1991). It was unanimously claimed that it was unclear how Silverman selected the studies to review in the various categories and sub-categories other than that they were published in the last 15 years. Dodds and Placek (1991) commented on the daring attempt of Silverman, in particular to devise categories for classifying types of research. They claimed that “his definitions are unsatisfactory sketchy”, and accused Silverman of sorting the collected studies with impunity, however they agreed that his interpretations of individual studies seemed accurate. This criticism was very harsh and as Goldberger (1991) pointed out, Silverman provided a useful review of RT-PE. Lee (1991) was more constructive, cautious and fair in her criticism. She stated that

“ although documentation of the numerous forms and findings represented in RT-PE makes interesting reading, before the research can lead to a theoretical understanding of teaching, methodological issues must be addressed more thoroughly. Silverman reported existing findings but failed to frame important issues needed to guide future research.”  
Lee (1991) pg. 378

Silverman and Skonie (1997) took this advice and came up with a study to identify, categorise and analyse published RT-PE. This analysis of research has been defined as different from literature reviews in that they categorised research instead of synthesising results, and provided information on research in a number of fields. RT-PE was operationally defined as research on the process of social dynamics and outcomes (motor skill, attitude, knowledge and fitness) of PE. This included studies related to teacher or teaching method and student action and excluded studies on teacher education and curriculum. The original three research streams identified by Silverman (1991): effectiveness, classroom ecology, cognition and decision-

making were retained, however, their subcategories were modified and extended. A fourth category, instrument development, was added. The main streams listed under research type (Silverman and Skonie, 1997) included effectiveness, classroom ecology, cognition and decision-making, and instrument development.

The analysis of Silverman and Skonie (1997) gave the percentages and the numbers of the research conducted for each category, namely:

➤ Effectiveness	85.5% (n=153)
➤ Classroom ecology	3.9% (n=7)
➤ Cognition and decision-making	5.6% (n=10)
➤ Instrument development	5% (n=9)

There was a large representation of research on effectiveness in spite of a recorded decline of effectiveness related research (Metzler, 1989). As Lee (1991, 1996) commented, investigations in areas such as cognition and decision-making were necessary to completely understand the dynamics of teaching. Effectiveness research provided information on the instructional process. Studies on cognition attempted to understand how teachers' and students' thinking mediated with achievement, thus providing an additional understanding of the teaching-learning process in PE. It has been noted that in a large number of studies the students have not been measured on any criterion variable- motor skill, attitude, knowledge, fitness, or the learning out-comes of PE, thus ignoring the effect of teaching on the student (Silverman and Skonie 1997).

### **2.3 The teaching of physical education**

Teaching has been described as “a complex, professional thinking activity” (Calderhead, 1987) possessing a body of specialised formal knowledge, namely “background knowledge in sport sciences, human movement studies, sport studies or the study of physical education” (Mawer, 1995, pg. 31). Teachers do things such as plan, explain, question, manage and provide feedback (Siedentop, 1991, pg. 7).

Siedentop (1991, pg. 23-24) identified the following qualities to describe the active teacher and the learning student after summing up the major findings from teacher effectiveness research (Smith, 1983; Brophy and Good, 1986; Rosenshine and Stevens, 1986; Evertson, 1989):

1. *Time, opportunity to learn and content covered:* effective teachers include ‘important content’ and allocate as much time as possible to that content.
2. *Expectations and roles:* The effective teacher communicates high, yet realistic expectations for achievement and work involvement, with the teachers’ and students’ roles in this process carefully defined.
3. *Classroom management and student engagement:* Effective teachers are good managers who establish routines and rules and see to their enforcement. Management is predominantly

positive. Coercive, negative, or punitive teacher behaviour is virtually absent from the effective class.

4. *Meaningful tasks and high success*: Tasks are arranged for students to be meaningfully engaged at realistic achievement levels.
5. *Pacing and momentum*: Effective teachers create and maintain a strong forward pace in their lessons and prevent disruptions.
6. *Active teaching*: Content is communicated to students and short, effective demonstrations are normally followed by guided active practice in which teachers frequently prompt and check for understanding.
7. *Active supervision*: During practice time, the teacher monitors progress, maintains an on-task atmosphere, and provides help where needed.
8. *Accountability*: A range of positively oriented mechanisms is used to hold students accountable for completing tasks.
9. *Clarity, enthusiasm and warmth*: Effective teachers are clear about their content and presentations and tend to be enthusiastic about the subject and their students, and try to maintain a warm classroom climate in which student attitudes can be positive.

Effective teaching skills, over recent years, have been of interest in an attempt to identify teaching skills and competencies. Kyriacou (1991) (cited in Mawer, 1995, pg. 34) defined essential teaching skills as “discrete, coherent activities by teachers which foster pupil learning”. He also identified what he considers three important elements pertinent to teaching skills:

1. *Knowledge*: about subject, pupils, curriculum, etc;
2. *Decision-making*: that occurs before, during and after lessons and is concerned with how best to achieve the educational outcomes intended.
3. *Action*: overt behaviour by teachers to foster learning.”

Kyriacou (1991) (cited in Mawer, 1995, pg. 40-41) further identified “essential teaching skills” that might contribute to successful classroom practice:

1. *Planning and preparation*: skills of selecting aims and learning outcomes and the best way of achieving them.
2. *Lesson presentation*: skills of successfully involving pupils in the learning experience and the instructional skills.
3. *Lesson management*: skills of organisation and management and ability to maintain pupil attention and involvement.
4. *Classroom climate*: skills of establishing a positive climate and attitude towards learning.
5. *Discipline*.
6. *Assessing pupils progress*: formative and summative forms.
7. *Reflecting and evaluation*.

The teaching skills and competencies for newly qualified teachers have also been identified by the DFE (1992). These are:

1. *Subject Knowledge*.
2. *Subject Application*.
3. *Class Management*.
4. *Assessment and Recording of Pupil's Progress*.
5. *Further Professional Development*.

The TEPE Project (Mawer, 1995 pg. 42) targeted the following skills and competencies of PE teachers:

1. *Knowledge*: including subject, content, National Curriculum knowledge as well as being informed about school organisation and special school events such as sports days.
2. *Planning and preparation*: in relation to the National Curriculum Programmes of Study, safety issues and differentiation of activities according to the abilities of the pupils.
3. *Organisation and Management*: including the efficient management of time and the appropriate use of equipment and resources, and classroom control and discipline.
4. *Use of a range of teaching styles*.
5. *Communication skills*: including clarity of expression, effective use of voice and the ability to demonstrate.
6. *Observational skills*: these include abilities to analyse and recognise skilful movement and the ability to assess pupils as a basis for progression.

Metzler (1990, pg. 61) compiled the following list of effective teaching-learning processes in PE:

1. *Time management*: pupil engagement in learning at an appropriate level of difficulty and success
2. *Resource management*: affecting pupil engagement time in learning.
3. *Task relevance and structure*: provision and design of a relevant and sequential progression of tasks.
4. *Behaviour management and task accountability*: task expectations and management procedures made clear to pupils with effective communication.
5. *Engagement success rates*: matching pupil development characteristics to ability levels of the task to ensure success for pupils; presentation of materials and tasks such that pupils understand concepts to be learned.
6. *Instructional cueing*: cues to aid learning (verbal, visual, written, audio and demonstration) presented in logical order.
7. *Performance feedback*: task, augmented and specific feedback.
8. *Class climate*: positive, enthusiastic and interesting environment.
9. *Planning*: clear aims and efficient methods to reach objectives, reflect and modify lessons.
10. *Verbal and non-verbal interaction*: higher rates of interaction are linked to higher rates of appropriate pupil engagement learning. (No research links interaction patterns with pupil learning.)
11. *Use of questions*: to establish pupil's understanding of concepts and skills. (There is little research support related to effective questioning in PE lessons).
12. *Content development*: learning experiences are designed to follow a clear sequence and progression based on pupil progress and ability.
13. *Regular evaluation of pupil's progress*: assess levels of achievement in relation to original instructional goals.
14. *Establishment of a safe and learning environment*: this does not have current empirical support for its role in effective teaching, however this is considered a necessary prediction for teaching many activities in PE.

These skills and competencies have been identified as yardsticks for effective teaching in PE. What is of interest to observe is that these skills extend beyond lesson delivery time and include planning, delivery and evaluation after the lesson. The extent to which these qualities have been included, documented and agreed with in RT-PE will be discussed in the following section.

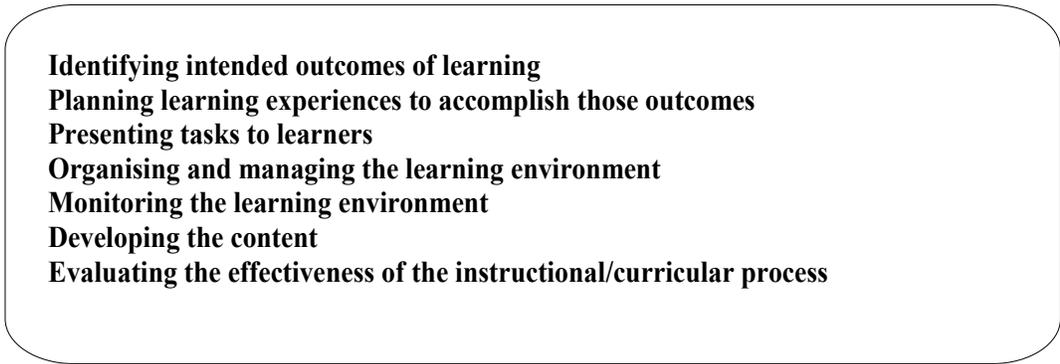
## 2.4 Effective teaching in PE

The question “what makes the difference between more and less effective teachers?” has been asked with increasing frequency. Teaching is influenced by so many factors, that identifying a single variable or even a limited series of variables cannot provide the answer to this question

(Piéron and Cheffers 1988). Most of what we know on effective teaching comes from process product research, which examines the relationship between characteristics of the teaching process and the products of teaching, often measured with student learning. The effective teaching literature has identified primarily generic variables related to teacher effectiveness; that is, those variables that seem to discriminate effective teaching across content and settings. More recent research has been concerned primarily with the identification of context-specific factors. The focus is on how effective teachers teach particular content to particular learners in a particular setting (Rink, 1996).

The search for a rigid prescription of the right way to teach has been shifted towards a search for propositional rules and principles to guide practice. What the teacher does is related to the function of a particular teaching act in a particular setting. Teaching functions have been identified at three phases namely: pre- inter- and post-active decision-making. More specifically Rink (1993) has described teaching functions for PE. These are illustrated in figure 2.2:

Figure 2.2: Teaching functions for physical education.



- Identifying intended outcomes of learning**
- Planning learning experiences to accomplish those outcomes**
- Presenting tasks to learners**
- Organising and managing the learning environment**
- Monitoring the learning environment**
- Developing the content**
- Evaluating the effectiveness of the instructional/curricular process**

Another yardstick for effective teaching proclaimed by Shavelson *et al.* (1986) equated effective teaching with large mean residual gains calculated for each student from pre- to post-skill. This perspective was different from the one in which students are put to the condition of learning or improving a skill (Magill, 1989). This definition represents learning as a relatively permanent change in performance as a result of practice and implies that the variable cannot be adequately measured by a skill test given immediately at the end of the unit. Lee (1991) argues that some of the divergent conclusions on decision-making teaching models in PE could be explained by the performance versus learning issues and the inability to separate temporary from more permanent learning situations.

Parker (1995) reconstructed high school PE teachers' views of effective teaching by examining the underlying rationale of experienced teachers using critical incidents, the Q-sort technique and informal interviews. Her results revealed that effective teaching was defined as a “hierarchy of pedagogical practices, in which organisation, management, discipline, and control from the base, with student success being the ultimate goal (Parker,1995, pg. 127). This finding supports an earlier study by Placek (1983), who concluded that teachers were more concerned with overt pupil behaviour than with the transmission of knowledge.

Teachers' educational value systems determined how they provided and used knowledge in teaching. Teachers were considered to be going through a process of “pedagogical reasoning” (Shulman, 1987, pg. 14) during which they integrated their knowledge about the content and pedagogy to make curricular decisions about what to teach. Research on physical educators' value orientations identified five orientations (Jewett *et al.*, 1995) which had an impact on the emphasis teachers place on curriculum content (Chen and Ennis, 1996). These are illustrated in figure 2.3:

Figure 2.3: Value-Laden orientations in physical education.

<b><i>Abbreviation</i></b>	<b><i>Value Orientations</i></b>
DM	Disciplinary Mastery
LP	Learning Process
SA	Self-Actualisation
SR	Social Responsibility
EI	Ecological Integration

Disciplinary mastery [DM] placed a focus on developing proficiency and performance in sport and an understanding of performance-related knowledge. The learning process [LP] orientation was central to teachers who believed that learning how to learn was of prime importance to the content of PE. The self-actualisation [SA] orientation assumed that the curriculum should be child centred and that developing personal growth was the ultimate goal of education. In addition, meaningful knowledge and skills taught in class acted as a vehicle to increase self-esteem. Teachers with the social responsibility [SR] orientation considered physical activities as a medium for pupils to develop social responsibility. Educators with an ecological integration [EI] orientation believed that a balanced curriculum provided equal considerations for the needs of the learner, the subject matter, the educational context, and social concerns. The main aim of the teacher was to encourage students to find a personal meaning through participating in various physical activities.

Findings of curricular value orientation research (Ennis *et al.*, 1992), suggested that social responsibility [SR] teachers were less effective than their disciplinary mastery [DM] and learning process [LP] colleagues in communicating their learning goals and expectations to students. Students in social responsibility [SR] teachers' classes reported that they were unclear about what they were expected to learn and were confused as to how the goals of the teacher (co-operation and responsibility) were to be matched with the content tasks (playing ball games most of the time). The evidence from this research suggested that the value orientations of teachers were often different from those valued in the PE curriculum and instructional literature (Ennis, 1992; Ennis *et al.*, 1992; Siedentop *et al.*, 1994). This fact that relatively few teachers in Ennis's (1992) study selected "disciplinary mastery" [DM] as a high priority, yet goals related to this value were acknowledged as the "performance" objective in PE syllabuses and textbooks, substantiate this statement. Siedentop *et al.* (1994) showed that "knowledge" as an objective rated low and the value orientations of disciplinary mastery [DM] and learning process [LP] were clearly the lower priority. The evidence from these investigations suggested that teachers often placed higher priorities on several value orientations, adopting an eclectic approach that was often constrained by resources and contextual influences. The delivery of the curriculum through instructional classes represented the major professional task of the teacher (Siedentop *et al.*, 1994). Curricular literature in PE has been on curricular models and value orientations (Jewett and Bain, 1985, Ennis, 1992). Our knowledge of what actually goes on in the name of PE resulted primarily from activity surveys (Hendry, 1978; Kane, 1974; Underwood, 1983; O'Sullivan *et al.*, 1989) and what one might infer from teaching research literature based on direct observation (Metzler, 1989).

Siedentop *et al.* (1994) utilised the ecological model developed by Doyle (1979, 1986) for the theoretical grounding for curriculum and instruction analysis. The aspects of the model that were most salient were the notions of creating order and maintaining a programme of action, with negotiation and accountability as primary mechanisms in the evolving ecology. Doyle (1986) explained that the main goal of the teacher was to create and maintain "order", a concept that brought together both the managerial and substantive aspects of teaching. Order was not just appropriate behaviour or absence of disruptive behaviour, but included references to the teacher gaining and maintaining co-operation with the students (Siedentop, 1991).

A study which looked at instructional issues concluded that if one considers skill improvement, increased ability for strategic play, and the acquisition of knowledge and appreciation of sport as the substantive outcome of units of instruction, then many of the class ecologies achieved modest gains at best (Siedentop *et al.*, 1994). An analysis of the

curriculum guidelines (CGs) of the schools under study in this investigation revealed that the programme goals and objectives included the traditional psychomotor, cognitive and affective domains. It was further concluded that the observers saw no instructional ecology and no programme of action that had the intensity whereby students were seriously and intensively engaged in learning activities. Indeed, it was quoted that the ecologies were closer to casual than intense, in both literal and symbolic senses; gym was “no sweat”.

Another aspect of teacher effectiveness was the relationship between the teachers’ background (personal biographies) and how they processed their thoughts and did their work (Dunkin and Biddle, 1974). In this research domain, Siedentop and Eldar (1989) emphasised the clarification of the terms effective teachers and experienced teachers. There was a risk of assuming that experience changed novice teachers into experts. The central question was whether experienced teachers (in number of years employed in the profession) ought to be equated with expert teachers (in the range and constellation of their teaching skills) (Dodds and Placek, 1991). In early expert-novice research strategy, experience equalled expert and beginner equalled novice. Continuing to use this research strategy is not prudent (Siedentop, 1991). Siedentop (1991) observed that for one to learn to teach effectively, one has to practice teaching and get feedback about one’s own performance and students performance.

Dodds and Placek (1991) argued that the construct of teaching effectiveness depends on who defines effectiveness (researchers, the teachers they study, or both), how it is defined (which specific dependant measures will account for student achievement and which independent measures will justify the teachers’ contribution and impact). They also added that the characteristics of teachers and students that affected their behaviour or performance set up a more sophisticated context for interpreting RT-PE. The students’ success in improving or exhibition of mastery of motor skills was often the measurement of effectiveness. In contrast, teacher-participants’ notions of teaching success were multidimensional and included far more than psychomotor achievement alone (Goc-Karp *et al.*, 1985.)

## **2.5 Subject and Pedagogical Content Knowledge**

The subject content knowledge that a teacher possesses, in this case knowledge related to the techniques and skills, tactics, rules and umpiring are not usually taught in their original form as stored in the teacher’s memory. A knowledge transformation is necessary because a teacher’s content knowledge is conceptualised in different yet related components that include subject content knowledge and pedagogical content knowledge (Shulman, 1986). Shulman’s content knowledge taxonomy referred to concepts, principles and skills within a particular subject discipline. The teacher’s knowledge of representations for presenting subject content

knowledge is then retained as pedagogical content knowledge. This knowledge consists of useful forms of representations for the subject content knowledge such as examples, illustrations, explanations, demonstrations, learning cues and drills. Chen and Ennis (1995) stated that the teacher is expected to be able to transform the subject content knowledge to pedagogical content knowledge. They also added that:

“Theories associated with teacher knowledge suggest that teachers transform subject content knowledge into pedagogical content knowledge in teaching to enhance the content comprehensibility”  
(Chen and Ennis, 1995 pg. 389).

This step of transforming content knowledge into pedagogical content knowledge was regarded as a critical step towards effective teaching. It was assumed that during the content transformation process, a teacher was required to address these questions:

“What are the core concepts, skills, attitudes which this topic has the potential of conveying to students?  
What examples, demonstration, simulations or the like, are most effective in communicating the appropriate understandings or attitudes of this topic to students..?”  
(Shulman and Sykes, 1986, pg. 9 cited in Wilson *et al.*, 1987)

The teachers’ underlying considerations influenced content knowledge transformations, since subject to pedagogical content knowledge transformation included interpretation, representation and adaptation stages. The teacher was required to be able to prioritise the key ideas, concepts and skills in the subject content knowledge and determined the representations for classroom presentation during the knowledge transformation. As such, the teacher should possess an understanding of the importance and the structural organisation of the subject content knowledge (Bruner, 1977).

### ***2.5.1 The Knowledge Structures (KS) Model***

The Knowledge Structure Model (KS Model) of instructional design in physical education (Vickers, 1990) is an activity-specific (e.g. netball) approach to teaching. This model requires all sport activities to be analysed using knowledge acquisition and representation techniques, with skill, strategies, and concepts displayed as a hierarchical knowledge structure derived from an analysis of expert sources, and adherence to recognised cross-disciplinary foundations. This model requires of teachers to become thoroughly knowledgeable about the practical activities to be taught. The process of analysing practical activities into knowledge structures was a pre-requisite for the transition of content knowledge to pedagogical knowledge. In formulating a model for instructional design, it was necessary to develop a model that combined domain specific knowledge structures. The KS Model categorised knowledge into declarative knowledge (what to teach) and procedural knowledge (how to teach), based on Andersons’ (1976) classification. Declarative knowledge is domain-specific, factual information that is often

represented as semantic networks consisting of concepts (Housner *et al.*, 1993). The subject content of sports activities such as knowledge on “rules of the game and player positions, goals and sub-goals of the game can be defined within the declarative knowledge structures” (French and Thomas, 1987). Procedural knowledge includes the analysis of learning and the cognitive decision-making processes involved in sports situation (French and Thomas, 1987). Chi and Rees (1983) suggested that a foundation of declarative knowledge was necessary for the development of procedural knowledge, thus a base of declarative knowledge base must be formed before one can develop good decision-making skills. This finding was confirmed by McPherson and Thomas (1989) who found that declarative knowledge of novice tennis players was a necessary base and needed time to develop and that it followed along with decision-making situations, thus relating it to procedural knowledge. Another study by French and Thomas (1987) also revealed that basketball knowledge was related to decision-making skills, whereas performance in dribbling and shooting were related to the motor components of control and execution. The contribution of motor execution to successful skill performance cannot be ignored, however, knowledge development regarding decisions of appropriate actions within the context of the game are often as important as the execution of motor skills.

Turner and Martinek (1992) analysed the impact of two teaching approaches, technique and tactical centred for teaching hockey (declarative and procedural knowledge) to 11-12 year old pupils over six lessons. They argued that it might be possible that students can develop successful strategies and response “sets” in games without being able to verbally express their knowledge base. Consequently the interplay between the acquisition of knowledge, skilful performance and the different types of instructions of physical activities needed to be investigated. They reported no significant increases for either declarative or procedural knowledge. This was partially explained because the subjects had no previous experience on field hockey and the treatment period of six lessons might have subjected the students to limitations on the amount of knowledge that could be mastered. Turner and Martinek (1995a) continued their investigation with a 15- lessons study unit of field hockey and although differences were found over the longer unit for declarative knowledge, there were no differences in procedural knowledge. Rink *et al.* (1990) examined the effects of three different treatments: tactical awareness, skill development, and combining strategy and skill development, on the knowledge base of 9<sup>th</sup> grade (age 14) novice badminton players. This study also reported no learning gains on the knowledge test, however, on the cognitive test, which was divided into knowledge of rules, technique and strategy, all treatment groups scored better than the control group. McPherson and French (1991) on the other hand reported that students’ declarative knowledge and decision-making during games increased dramatically when strategy was emphasised first. However, one must note that the subjects of this study were adult beginning tennis players who had been assigned readings about

the game prior to treatment. The contrasting findings of these studies indicate that the age of the subjects seems to be an important factor in the effectiveness of different treatments.

The failure of motor behaviour research to relate sport-specific knowledge base to sport skill performance has been emphasised by Thomas *et al.* (1986) who argued that the knowledge base may have effects on performance of children in sport situations, especially in highly structured, goal-oriented sports that require a repertoire of cognitive as well as motor skills. They also argued that the distinction between knowledge types (declarative, procedural and strategic (Chi, 1981)) provide a useful framework for categorising knowledge. Thomas *et al.* (1986), also pointed out that the distinction between discrete and continuous sport skills is important since in continuous activities, there is no break in action for preplanning whereas in discrete skill execution players have time to pause between sequences of actions.

An experimental study on co-educational classes of 12 year olds (Ikulayo, 1991) was conducted to discover the relative effectiveness of five different instructional strategies (i. Demonstration with verbal feedback, ii. Verbal description with verbal feedback, iii. Demonstration, proprioceptive awareness with verbal feedback, iv. Verbal description, proprioceptive awareness with verbal feedback, v. Combination) on the acquisition of four psycho-motor skills (i. continuous volleying in volleyball – a continuous skill, ii. Zigzag dribbling round 10 obstacles in hockey – a continuous skill, iii. Headstand in gymnastics- a discreet skill, iv. Sail long jump in athletics – a serial skill). The results obtained for the continuous skills revealed a significant difference in the effectiveness, with the ‘Combination’ teaching method found to be the most effective. The method of demonstration with verbal feedback was found to be the least effective for volleyball, but it ranked second for hockey. This finding implies that there is no conclusive evidence regarding the relationship between instructional strategies and type of skill. The fact that demonstration was not found to be an effective instructional strategy is contradictory to Siedentop’s (1991) suggestion that the demonstration method was highly effective. On the other hand, none of the five instructional treatments were found to be significantly different for the gymnastics skill and the athletics skill. This study also revealed that boys outperformed girls in all skills (volleying, zigzag dribbling in hockey, headstand and sail long jump) when the mean scores for each skill were compared across all instructional methods. No one method was found to be exclusively most effective for teaching and learning all the four selected psychomotor skills, but the combination method was slightly favoured.

Thomas *et al.* (1986) offered a paradigm for the development of sport skill research, one of which is precisely the suggestion to investigate the relation between sport knowledge, specific

sport skills and actual game performance. Fleming (1994) argued that much of the recent discourse has focused on the mode of delivery and learning outcomes. He also goes on to mention the work of Thorpe and Bunker (1986), which, he argues, has brought a significant shift of emphasis away from a behavioural focus towards a more cognitive approach. This innovation has been given the generic term “games for understanding” (Thorpe *et al.*, 1986).

### **2.5.2 GFU Model**

The “Games for Understanding” approach proposed by Bunker and Thorpe (1982) has initiated concern and a movement towards tactical approaches for games teaching. This was justified since their observations revealed that “games teaching showed a series of highly structured lessons leaning heavily on the teaching of techniques” (Bunker and Thorpe, 1986). They added that the uniqueness of games is the “decision-making” process that precedes the technique employed. However, the understanding concept does not suggest that techniques should not be taught, it merely advocates that the game itself should be the focal point of each lesson and that techniques should be taught within the context of the game (Lee, 1987). Studies comparing technical and tactical approaches to games teaching (McPherson, 1994, Taylor *et al.*, 1993 cited in Oslin *et al.*, 1998) have reported a significant improvement in declarative knowledge for subjects who received tactical instruction when compared to subjects in other treatment groups. The argument for an understanding approach to the teaching of games in PE is concerned with providing greater equality of opportunity to all learners, and empowering them to take responsibility for their own learning (Laws 1990). This approach is characterised by a focus on the development of tactical awareness and decision-making within the framework of an appropriate game, the use of modified games and the teaching of skills when appropriate (Stuart and Thorpe 1997). Almond (1986) observed that a number of teachers see teaching for understanding in terms of small sided games and mini-games and then they argue that they are doing this work already. This misunderstanding to which he refers, is to confuse an understanding approach with what might be called teaching “through games”, in which the playing of the games, rather than the practising of skills, becomes the focus of the learner’s experience.

Fleming (1994) also argues that:

“playing a game does not explicitly develop an understanding of that game; particularly when the play is focused on techniques and tactics that have merely been transplanted from skills, practices and drills that have been previously rehearsed”  
(Fleming, 1994, pg. 94)

The assumption that teaching GFU encourages critical thinking, even though students have not necessarily been taught how to think is a problem (Luke and Hardy, 1999a). While skill proficiency is important, it is only one facet of game play since in team games, a considerable portion of time is spent off-the-ball and decisions made by supporting players are essential if a team is to be successful (Mitchell *et al.*, 1994). Skill and game performance are often used

synonymously: However, research has divided game performance into cognitive and skill components. Decision-making and knowledge are included in the cognitive component. Motor execution components, e.g. shooting, passing, dribbling, is analogous with skill (Thomas Thomas, 1994). Advocates of the GFU approach point to the failure of many students who can do a skill in a practice situation but cannot use it in a game (Turner and Martinek 1995b) as evidence that teaching skill first does not work. It was further argued by Oslin *et al.* (1998) that students without a high degree of skill can still play the game if they have a tactical understanding of the game. Mawer (1993) commented that there is more than the learning of physical skills in PE. Indeed Read (1993) argued for an alternative approach to teaching games, involving pupils in planning, performing and evaluating. Stuart and Thorpe (1997) reported that pupils taught through the “GFU” approach were involved considerably more in planning and evaluating than they were in the skills based lessons.

Chandler and Mitchell (1991) observed that there was very little empirical evidence to support the idea that a GFU approach was any more effective in teaching games to PE classes than other approaches. A GFU approach was a pedagogical curriculum orientation to a teaching approach, identifying the environment designs and the strategies to be used more explicitly (Rink, French and Tjeerdsma, 1996). They added that from a pedagogical research perspective further investigation was required to describe how strategy is accessible and should be taught. They contended that the performer has a conscious control of what to do and will not come to these ideas as a result of playing the game. They also argued that skill should not be taught first because tactical awareness precedes technical skill development. They suggested that strategies be taught indirectly to beginner players. Rink, French and Tjeerdsma (1996) pointed out that research has failed to investigate the notion that strategies could be taught very directly for specific and specialised knowledge. Mitchel *et al.* (1994), identified the need for research to examine and investigate the strategy demands in specific sports, and sequence the introduction of these strategies developmentally. Games tend to be the predominant curricular activity in secondary PE and though rules and strategies for playing games have changed over the years, methods used to teach and assess games have changed very little (Oslin *et al.*, 1998).

## **2.6 The use of video assisted instruction**

The advances in sport sciences have promoted the analysis of motor skill through the use of computers and high-speed film. Meanwhile, the majority of teachers use a qualitative model to analyse movement performances (Eckrich *et al.*, 1994). Hoffman (1974) described a hierarchical model used to analyse tasks. This includes the skills of observation, evaluation and diagnosis. Pinheiro and Simon (1992) supported the need for skill analysis training in live and simulated environments, however the majority of training programmes aimed at developing

the skill analysis process have used the video environment (Wilkinson, 1991; Morrison and Reeve, 1988).

The advantage of videotapes is that they are repeatable, accessible and can include a wide variety of movement responses. Ignico (1994) found that videotape directed instruction contributed to knowledge, performance and assessment of fundamental motor skills of undergraduates significantly better than teacher directed instruction. Eckrich *et al.* (1994) concluded that video training improves video observational skills and suggested separate training for live performances. On the other hand, Chung (1992) did not find significant differences between a group that received two hours of video interactive instruction as opposed to the same time of traditional lecture presentations for tennis psychomotor skill analysis for undergraduates, in addition to a practice-based course. He also reported that there were no differences between the groups for a written knowledge test, a video analysis test and a performance test. It is observed that while all these studies were concerned with undergraduates, the skills of observation, analysis and evaluation were a central part of the GCSE and 'A' level PE curriculum and thus have implications for teaching.

## **2.7 Summary**

The trends on research in physical education focused on presage, context, process and product variables and this helped teachers understand what pupils did but no characteristics of effective teaching were offered. Pedagogical research using instruments of systematic observation got as far as describing what happens in the classrooms, while investigations of strategies facilitating the acquisition of motor skills attempted to identify a "best" teaching approach. This attempt failed and the focus turned on to how effective teachers teach sport specific content to particular learners in particular settings (Rink, 1996). These led to the classification of pedagogic content knowledge into procedural and declarative components, thus promoting cognitive and decision-making processes in understanding the dynamics of teaching and learning. Approaches to teaching such as the KS and the TGU models had the knowledge and the understanding elements at their core, and brought forward the idea that the teacher should be in possession of a discipline of sport specific knowledge. This became central with the introduction of CSE exams (Carroll, 1982). The use of video assisted instruction for various content and cognitive domains of the practical coursework have shown significant better results than teacher directed instruction in the practical setting and /or on a class-based environment.

In the era of accountability, effective teaching in physical education has been defined through a range of teacher skills, competencies, characteristics and guidelines related to preparation, delivery

and evaluation of lessons. This is somewhat disappointing as the main focus of effective teaching is being equated with classroom organisation and teaching skills and not the pedagogic means necessary for transforming learning tasks enhancing the cognitive development of all children (Simon, 1999). Methods used to teach cannot remain isolated from methods of assessment, as the impact of teaching on learning and summative assessment is central to examined courses in PE.

The following part of this chapter will provide a description of the assessment methods used in GCSE and 'A' level PE and will attempt to identify the gaps between teaching, learning and assessment methods used for the practical performance coursework of PE.

## **PART 2**

### **Assessing physical education**

#### **2.8 Introduction**

This second part of this chapter will initially explore the implications of the emerging theoretical frameworks considering the link between learning theories and assessment (Murphy, 1999). The principles of assessment will be reviewed and related to the modes of assessments of the practical performance of PE coursework. The main focus of the discussion of this chapter will be on the classification of activities, and the structure and the nature of assessments of the practical performance coursework component of PE. In particular, the modes of assessments used for the content and cognitive domains of the practical performance coursework in PE will be analysed with reference to the principles of assessments. The problematic issues related to the administration and recording of evidence of the performance coursework assessments and the implications for teaching as divulged in the examiners' reports (AEB, MEG, NEAB, SEG, ULEAC/EDEXCEL) will be discussed and the problematic areas warranting investigation will be identified.

#### **2.9 Integrating teaching, learning and assessments in PE**

The function of assessment that is directly concerned with learning is being neglected, both in public policy and in classroom practice (Black, 1999). He argued that classroom practices are based on assumptions of learning and these are powerful in determining practices, thus although all teachers look at their pupils' performances, ask questions, set and mark written activity where appropriate, the quality of this work is variable. The behaviourist approach to learning focuses on the actual response, giving little attention to the thinking process that occurs between stimulus and response. It follows that distinction between rote learning and learning with understanding is not considered. Shepard (1992) commented that children who do not develop

“a basic conceptual model or seeing the meaning of what they are doing have a very difficult time retaining information (because all the bits are disconnected) and are unable to apply what they have memorised (because it makes no sense)” (pg.303)

The constructivist approach focuses on the development of models of mental processes keeping the learner engaged in active analysis and transformation of any new information through direct action and self-directed problem solving. Activities of a formative assessment nature that are learning as opposed to performance orientated have been found to be more motivating to pupils (Schunk, 1996). Summative assessments, designed to give an overall picture of performance, included an aggregate of several pieces of evidence (Black, 1999). The variety of test items such as written papers, oral exams, project work and performance serve both to reflect a range of aims of the learning in authentic ways, and to reduce bias which can arise because different candidates respond better to some kinds of contexts and challenges than to others. However, these assessments are costly both in time of students and teachers and in the finance to pay examiners and administrators. Summative assessments often include teacher assessments because it is not possible to make valid assessment of some learning aims by short external written examination (Black, 1999). A system of portfolios, in which students select and assemble samples of their works throughout the year, is coming into acceptance. However, in the context of performance based subjects such as PE this is relatively problematic as exhibiting competence and mastery of skills, and the recording of knowledge, analysis and evaluation of performance requires a combination of video, auditory and written evidence.

The attempts to implement assessments in PE have generated some educational and procedural concerns (Macdonald and Brooker, 1999). Teachers had to shift their focus of their teaching approaches to position assessment as integral to the teaching-learning process and not something which is done summatively at a particular time as a “bolt-on” extra (McConachie Smith, 1991; Carroll, 1994). It is widely argued that physical activity is central to PE and that preference is given to performance pedagogy (Tinning, 1991), although labels to testing “theory” and “practical” have emerged (McConachie Smith, 1991). There has been an attempt to integrate the learning and assessment of the practical and theoretical skills, knowledge and understanding, even though theory is generally regarded as being the most legitimate indicator of student achievement (Macdonald and Brooker, 1999). One examining board has encouraged teaching through theory and practical- based sessions.

"many more centres had taken the examiners' advice and taught these activities within the classroom as well as through the activity itself"  
(MEG, 1993, pg. 7)

The standardising of assessments in PE is being addressed with the publications of support materials for teachers, describing detailed levels and criteria of performance and assessment. The publications of video tapes, providing models of levels of performance as described in the assessment criteria and the setting up of situations /tasks for assessing various learning outcomes were made available by some examining boards (LEAG, 1992; AEB, 1997c; SEG, 1996b; SEG, 1998c). The comparability of teachers' judgements for summative assessments in PE included the observation and judgement of student performances against pre-specified criteria for success, where students were awarded a particular mark/grade within a designated level of achievement, of equivalent quality, regardless of the school attended.

Summative assessments in the practical performance coursework of PE brought the teacher central in the process of assessment. From the documentation available from the examining boards, it is evident that the power and the role of the teacher in this part of the collection of evidence has been changing and increasing. The struggle for the balance of the appropriate forms of evidence for the purpose of summative assessments is reflected in the changes of assessments as from 1998, however, these changes need to be reviewed in the light of the principles of assessments, which will be discussed in the following section.

The terms assessment modes and methods are often used interchangeably, however, in the following discussion these will be referring to formal assessments, which require a pre-planned technique that produces a written record of performance, knowledge or behaviour (Veal, 1988). The modes of assessments described by Rowntree (1977) offered a spectrum of the methods, purpose, criteria, context and content of assessments. Linn and Grondlund (1995) further explained that assessment is a general term that includes the full range of procedures used to gain information about student learning, and the formation of value judgements concerning learning processes. Thus, the terms modes and methods of assessment will be referring to the procedures and process used as part of a formative assessment process.

## **2.10 Principles of assessments**

Carroll (1994) identified validity, reliability, objectivity and clear criteria as the four fundamental principles of assessment in PE. These were suggested as criteria against which one can question the method, mode and technique used to carry out assessments. Carroll (1994) also identified secondary principles of assessment namely, variety of situations, balance of techniques and equality of opportunity.

Validity in assessments refers to the adequacy and appropriateness of the interpretations made from assessments, with regard to particular use (Linn and Grondlund, 1995). The case for

passing evaluative judgements on the evidence of the degree of validity (high, moderate or low) of an assessment is based on three considerations; content, criterion and construct (Ebel and Frisbie, 1991). Content validity is aimed at appraising how well the sample of assessment tasks *represents* the domain of tasks to be measured, while criterion validity is concerned with how well the test performance *predicts* future performance or *estimates* current performance on some valued measures other than the test itself. Linn and Grondlund (1995) observed that rigorous judgements regarding validity based on content considerations should not be confused with face validity, which refers to the appearance of the test such that the test items are meaningful.

This raised a central question in GCSE and ‘A’ level PE as the emerging modes of assessments of the practical performance coursework namely, physical performance which is required by all examining boards, answering questions in writing, (AEB, 1997a; MEG, 1997a; SEG, 1997a; ULEAC, 1997a; WJEC, 1997), oral assessments (AEB 1997a), and video based assessments (WJEC, 1997), might appear an “unusual” experience for the examinee. If students are not trained to observe and communicate (orally / written) the descriptions and evaluations of techniques and tactics practised and possibly discussed in a physical performance session on the field, one needs to question the face validity of these forms of assessments.

Construct validity evidence is judged by determining how well an assessment can be interpreted as a meaningful measure of some quality or ability. This implies that the test items need to be related to the teaching objective, content and teaching methods used such that the mode of assessment is regarded as relevant to the curriculum. Given the emerging assessments in GCSE and ‘A’ level PE syllabuses on various content and cognitive domains (planning, performance and evaluation) through the practical performance situation (AEB, 2000; EDEXCEL, 2000; NEAB, 2000; NICCEA, 2000; OCR, 2000a; OCR, 2000b; SEG, 2000) the question of construct validation becomes paramount. An example of lack of construct validity is when a candidate’s ability to umpire is based solely on the knowledge of rules, when the umpiring situation requires the application of the rules, an analysis and evaluation of the play situation (does it infringe any rule?), and a decision accompanied by specific actions such as whistling to stop play, signalling/announcing the infringement to the player /table officials, awarding the right penalty and resuming play. Examiners have noted that construct and content validation components need to be given their due importance:

“Most of the sport requires evidence of tactical awareness so ensure that the small sided games allow this aspect to be shown clearly” (ULEAC, 1996a, note 4.2.3)

Linn and Grondlund (1995) also noted that the level of validity evidence judgement can be passed after evaluating all considerations of validity, as a test item might have content validity but lacks construct validity. Validity also includes an evaluation of the adequacy and appropriateness of the assessment, taking into account important content not covered by the test (Messick, 1989).

Reliability refers to the consistency of assessment results and refers to a scenario whereby if the same assessment is given on different occasions or to different groups, the same results are expected (Linn and Grondlund, 1995). Reliability is more of a statistical measure related to validity, however a valid assessment is not always reliable. For example assessment of psychomotor (performance) and cognitive components (planning and evaluating) of practical activities through open ended questions, can easily fall low on reliability unless clear and explicit criteria of what is to be assessed are applied to the assessment method.

Objectivity has been described as the extent to which an assessment is free from a personal bias (Carroll, 1994). What goes on in most physical activities, unless it is a measure based on time, distance or goals scored, can all be regarded as 'subjective' performance. It is necessary for the assessor to free oneself from personal impressions and focus on applying the assessment criteria. The clarity of the criteria is essential for valid and reliable performance based assessments, as these will make known what is it specifically that the assessor is evaluating and passing judgement on.

The secondary principle of variety of situations refers to the types of situations necessary to assess all the assessment objectives. One examining board published a list of suggested activities for the assessment sessions of a selection of physical activities (ULEAC, 1995b; EDEXCEL, 1998b).

e.g. "Volleyball: *Set*, candidates work in pairs, with one ball between two. They volley or set the ball to each other, attempting to keep it in the air". (ULEAC, 1995b, pg. 11).

Similar descriptions were given for the dig, smash, spike, service and game situation. There were also details of the resources and facilities required for this assessment, and the time for administering the assessments given a number of candidates. In the same handbook, the assessment criteria for volleyball provided graded statements on the performance of the activities suggested for the assessment session. These kind of specific set ups for the performance assessments also provided a balance of techniques to be assessed. In spite of this, examiners (ULEAC, 1996b) observed, as noted earlier, that evidence of for instance tactical awareness, needed to be made clearly observable in small sided games. From the publications made available by the examining boards (syllabuses, performance assessment handbooks and

videos), one finds clear details of the performance coursework that needs to be taught. These also include guidelines for oral assessments or task sheets, assessment criteria and the marking sheets to be used, but there are no specifications as to how the performance assessments are to be structured and conducted. It is not clear whether teachers set up their own activities for assessment sessions or whether they are given specific set ups of situations to assess designated content. Examiners have reported that during moderation sessions:

- “ staff should ensure that facilities, demonstrations and practices are developed to show able candidates their true potential...and that questioning for candidates for section C (observation and analysis fault correction and synthesis) should be carried out by the person responsible for that practical area of the course - not the moderator” (AEB, 1998b, pg. 8-9).
- “Re: Internal assessment of coursework:  
Some centres need to pay more attention to the organisation of the (assessment) session and refer to the Board’s guidance in the Support Pack” (NEAB, 1998b, pg. 25).
- “Re: Analytic investigation and the performance improvement programme:  
Centres should consider the following:
  1. the need to avoid complex presentations which are difficult to unravel in terms of application of criteria.
  2. Candidates need to organise and present the investigation according to the criteria, namely planning and implementation, analysis and evaluation” (NEAB, 1998b, pg. 26-27).
- “It is not necessary to have candidates demonstrating all of the skills listed in the syllabus but rather a selection which are carefully selected so as to be appropriate to the group’s ability ” (ULEAC, 1996a, note 4.2.3).
- “The way in which the examination day was seen by the moderators raised one or two interesting comments and suggestions. In particular it was felt that the selection of drills offered was not always appropriate to all levels of candidates who were demonstrating their skills... The drills used were not seen as sufficiently challenging and as a consequence candidates were rarely stretched or placed in situations which called for the tactical knowledge or techniques required for a level 7.” (ULEAC, 1997b, pg. 7).

The above statements raise concern over how the performance assessments are being administered and at this stage one needs to evaluate the contribution of assessment sessions “constructed” by the teacher to assessment validity. Is it not better for the examining boards to issue standard activities suitable for practical assessment sessions for the performance coursework? From the above statements it is evident that in the absence of standardised assessment procedures, both the performance assessments and the analytic investigation component of assessments are suffering threats to validity and reliability.

The notion of equality of opportunity regardless of sex, ability and ethnicity during assessments of PE has been pointed out by Carroll (1994), who advocated that insensitivity to sex differences, special needs and cultural traditions can lead to disadvantages to both boys and girls in different activity contexts. Mixed sex grouping seems to provide more disadvantages than single sex grouping for the purpose of assessments, where marks tend to formalise the situation. This notion of gender differences has also been pointed out to the centres (schools) by examiners who stated that:

“When assessing males/females within the competitive performance aspects of the assessment, they should be assessed against the specific gender coursework tables, or, males v males for instance in basketball and females v females game. When assessing technique, these are against set criteria, and good technique in shooting for example, is the same for either male or female. This applies to all activities” (AEB, 1998b, pg. 9).

It is interesting to note that examining boards are announcing the existence of provisions for candidates with physical disabilities or who have problems with performance assessments (EDEXCEL, 2000, pg. 4, OCR, 2000a, pg. 8).

The assessment of the practical coursework for the sitting of 1997 (NEAB, 1997) consisted of demonstrating practical performance in four physical activities. This examining board offered a substantial amount of activities; Group 1: 21 activities, Group 2: 20 activities. Nevertheless, the chief examiners report stated that access for candidates to the full range of activities, especially those in Group 2 (individual activities) on offer in the syllabus was restricted due to “poor facilities within centres” (NEAB, 1996, pg. 21). The examiners also reported that centres were concerned about the comparability between activities in terms of the complexity and the range of skills. Teachers found the syllabus requirements for the assessment of Modern Educational Gymnastics as excessive in relation to other activities (NEAB, 1996, pg. 22).

The principles of assessments were discussed with reference to the performance coursework content assessments of PE (GCSE and ‘A’ Level) that took place between 1996 and 2000. An overview of the classifications of physical activities in PE now follows in an attempt to illustrate the levels of a balanced assessed PE curriculum.

### **2.11 Classifications of physical activities in PE curricula and examined courses**

The PE curriculum literature has addressed a variety of issues related to what goes on during PE (Kane, 1974; Underwood, 1983), the rationale justifying the inclusion of specific activities (Armstrong, 1992; Melograno, 1996) and the complexity of introducing assessments in PE based on National Curriculum with PE as a foundation subject (Carroll, 1990b; 1994). These authors have identified a selection of activities, movement experiences and

classifications/areas of sport activities that are part of activity based curricula. At this stage one needs to question why is it necessary to include classifications /areas of activities in the curriculum? The existence of these classifications in a curriculum provide a variety of activities and opportunities to enhance health, psychomotor and cognitive development and socialisation of learners into valued cultural forms such as participating in recreational, health and sport activities. It is not the intention of this discussion to evaluate the relevance of these classifications to the educational process, as this has been done elsewhere (Alderson and Crutchley, 1990; Armstrong and McManus, 1996, McConachie-Smith, 1996). Neither will the discussion tackle the emerging problematic nature of classification of activities as a possible reason for the gender imbalance in favour of male students selecting PE as an examinable subject (Carroll, 1995; Cooper, 1995, 1996). The following discussion will attempt to highlight the impact of the recent changes of the content structure of the classifications of activities of GCSE and 'A' level PE. It will also set the backdrop for a consideration of particular methods of teaching and assessing activities from different classifications of activities.

Alderson and Crutchley (1990) provided a typology of activities in an attempt to show the breadth and variety of activities that might be called sport. Their typology included four categories namely; i. organised competitive activities; ii. conditioning activities; iii adventure activities and iv. new games (co-operative as opposed to competitive situations). They go on to suggest that students in the 11-14 age bracket need to experience a representative range of each of these classifications of sport activities, while leisure, health and vocational themes need to be addressed from age 14 through 19. The six areas of activities (programmes of studies) of the National Curriculum for England and Wales (DES 1992) were athletics, dance, games, gymnastics, outdoor pursuits and swimming. From these two classification one observes that competitive activities and adventure activities are central while conditioning activities, new games, health, leisure, recreational and vocational aspects are somewhat underestimated in the PE National Curriculum. The inclusion of "games" for KS4 (ages 14-16) is a narrow view of PE given the requirements of at least three areas of activities for examined courses (GCSEs) and the leisure, health and vocational themes suggested by Alderson and Crutchley (1990).

The practical performance coursework component is an area where every examining board retained a relative amount of autonomy with regards to the classification of activities. Prior to the requirement of examining boards to use the six areas of activities of the National Curriculum (1995) as from the sittings of 1998, the physical activities offered were organised under a list or category (MEG, NEAB, SEG, ULEAC). In table 2.1, the descriptions given in parentheses are a mere grouping of the list/category added on by the author to illustrate the

nature of the activities. The other examining boards (NICCEA, WJEC, AEB, OCEAC) have used classifications describing the content of the grouped activities. The classifications shown in table 2.1 were taken from PE syllabuses (GCSE PE: MEG, 1997a; NEAB, 1997; NICCEA, 1997a; SEG, 1997a; ULEAC, 1997a; WJEC, 1997; and ‘A’ level: AEB, 1997a; OCEAC, 1997)

Table 2.1: Classification of physical activities for examined physical education prior to 1998

<i>Examining Board</i>	<i>Classifications of activities</i>	<i>Number of activities for physical performance assessment</i>
<b>GCSE</b>		
MEG	<ol style="list-style-type: none"> <li>1. Category A (team, net/wall and dual activities)</li> <li>2. Category B (Other activities)</li> </ol>	4
NEAB	<ol style="list-style-type: none"> <li>1. Group 1: (Games and net/wall)</li> <li>2. Group 2: (Individual Activities)</li> </ol>	4
NICCEA	<ol style="list-style-type: none"> <li>1. Athletics</li> <li>2. Dance</li> <li>3. Fitness Training</li> <li>4. Games 1</li> <li>5. Games 2</li> <li>6. Gymnastic Activities</li> <li>7. Outdoor education</li> <li>8. Swimming/lifesaving</li> </ol>	4
SEG	<ol style="list-style-type: none"> <li>1. Group 1 (Games)</li> <li>2. Group 2: (Net/racket games)</li> <li>3. Group 3: (Individual Activities)</li> </ol>	5
ULEAC	<ol style="list-style-type: none"> <li>1. List A: (Team Games)</li> <li>2. List B: (net/wall activities)</li> <li>3. List C: (Individual Activities)</li> </ol>	5
WJEC	<ol style="list-style-type: none"> <li>1. Gymnastics</li> <li>2. Dance</li> <li>3. Striking Activities</li> <li>4. Team games</li> <li>5. Individual/pair activities</li> <li>6. Environmental challenges</li> <li>7. Athletics</li> <li>8. Swimming</li> <li>9. Trampolining</li> <li>10. Weightlifting</li> </ol>	4
<b>‘A’ Level</b>		
AEB	<ol style="list-style-type: none"> <li>1. Individual Activities</li> <li>2. Games</li> </ol>	2

<i>Examining Board</i>	<i>Classifications of activities</i>	<i>Number of activities for physical performance assessment</i>
OCEAC	1. Individual activities: 1.1. Athletic and Aquatic 1.2. Aesthetic 1.3. Combat 1.4. Outdoor and Adventurous Activities 2. Game activity 2.1. Invasion Games 2.2. Striking/Fielding Games 2.3. Net/Wall Games	2

These classifications imply that the grouping of activities into classifications prior to 1998 has not been conspicuous and consistent with the National Curriculum areas of activities. However, these had some sort of common criteria (e.g. net/wall games) across all examining boards. There was also evidence of classifications such as aesthetic, combat and fitness activities that are particular to selected examining boards (OCEAC, NICCEA). The practical assessment handbook of the WJEC (1996) included a classification according to the six areas of the National Curriculum before this became a pre-requisite. It is of interest to note that four GCSE Boards [MEG, NEAB, NICSEAC, WJEC] required candidates to be examined in four physical activities, and the remaining two in five activities [SEG, ULEAC]. For a more detailed account of this component see Cassar (1995). The number of activities required for performance coursework assessment (i.e. 4-5 for GCSE; 2 for A level) have not changed for the examinations of 1998-2000. This came as a surprise, since this arbitrary reduction of practical coursework in the case of GCSE gives rise to the question of academic parity of the GCSE PE qualification. With regards to the two physical activities for the OCEAC syllabus, it is recommended that “during the course, candidates should experience a range of activities ... (at least four sections, and preferably all sections)” (OCEAC, 1996 pg. 30).

The amount and balance of the activities offered for the performance assessment were essentially dependent of the classifications of activities. In the case where two groups of activities were presented in the syllabus (MEG, NEAB) chief examiners expressed the worry of “many moderators” who felt that some candidates were put at a disadvantage because of the “narrow curriculum” offered in some centres (NEAB, 1996, pg. 21). The examiners urged centres to broaden their practical assessment curriculum. They suggested ways of accessing facilities through co-operation between centres and increasing the use of out of school facilities. The activities offered by each board for GCSE and Advanced level for the summer sitting of 1997 are presented in appendix 2. 1.

In some examiners' reports, the most popular activities selected for performance coursework were reported. MEG reported that from Category 1 activities, Association Football, Basketball and Athletics continued to be most popular among boys, whereas Netball, Badminton and Hockey were the most popular amongst girls. From Category 2 activities, with the exception of Rounders, it was difficult to identify one activity which was more popular than the rest (MEG, 1993, pg. 12). ULEAC reported on the consistent popularity of physical activity questions selected from the three groups of activities with Association Football, Basketball, Hockey and Netball being most popular from list A; Badminton and Tennis from list B and Athletics and Swimming from list C (ULEAC, 1996a, note 2,7). Examiners have not been reporting regularly on the selection of activities and it would be of interest to know the number and the gender of the candidates selecting specific physical activities.

It was worth noting that Carroll (1995) concluded that GCSE and 'A' level PE syllabuses did not reveal any gender biases possibly because both male and female PE specialists drew them up. He also reported that surprisingly, very few female students of either GCSE or 'A' level found the subject more suitable for males, and there was rather a tendency for males to state that rather than females. This means that females did not perceive the subject in gender specific terms, however, they might be conforming to gender stereotypes. Meanwhile, Strand and Scantling (1994) revealed that when asked to select their top ten physical activities from a list of fifty one activities for a PE programme, senior high school males and females listed six of the same activity (weight training, volleyball, basketball, swimming, soccer and racquetball) as their preferred activities, albeit in different order. These are presented in table 2.2. The table also includes a classification of activities used by Strand and Scantling (1994) (team activities/individual and dual activities) and the six areas of the activities of the GCSE and 'A' level PE and the PE National Curriculum.

Table 2.2: Top ten preferred activities

<b>Males</b>	<i>Classification</i>		<b>Females</b>	<i>Classification</i>	
	<i>Strand and Scantling 1994</i>	<i>Areas of activities</i>		<i>Strand and Scantling 1994</i>	<i>Areas of activities</i>
1. Weight training	<i>Individual</i>	<i>Athletic</i>	1. Volleyball	<i>Team</i>	<i>Game: net</i>
2. Basketball	<i>Team</i>	<i>Game: invasion</i>	2. Swimming	<i>Individual</i>	<i>Swimming</i>
3. Swimming	<i>Individual</i>	<i>Swimming</i>	3. Aerobics *	<i>Individual</i>	<i>Athletic/Fitness</i>
4. Football	<i>Team</i>	<i>Game: invasion</i>	4. Soccer	<i>Team</i>	<i>Game: invasion</i>
5. Archery*	<i>Individual</i>	<i>(Game: target)</i>	5. Basketball	<i>Team</i>	<i>Game: invasion</i>
6. Soccer	<i>Team</i>	<i>Game: invasion</i>	6. Tennis	<i>Dual</i>	<i>Game: net</i>
7. Volleyball	<i>Team</i>	<i>Game: net</i>	7. Weight Training	<i>Individual</i>	<i>Athletic</i>
8. Golf	<i>Dual</i>	<i>Game: target</i>	8. Ice Skating	<i>Individual</i>	<i>Dance</i>
9. Racquetball	<i>Dual</i>	<i>Game: wall</i>	9. Racquetball	<i>Dual</i>	<i>Game: wall</i>
10. Field Hockey	<i>Team</i>	<i>Game: invasion</i>	10. Backpacking	<i>Individual</i>	<i>Outdoor Adventure</i>

\* Not offered by any examining group in the United Kingdom for 1997 or 2,000.

From the table it is evident that for the top five activities, males selected two team activities (invasion) and three individual activities (athletic, swimming and target). Females selected three team games (one net and two invasion) and two individual activities (swimming and athletic/fitness). It is also evident that in this study outdoor pursuits were selected by females only. This study indicates that there is interest in activities other than games for the 14+ age group, by both male and female students.

For the examination sittings of 1998 onwards the organisation of classifications of activities was streamlined with the National Curriculum six areas of activities, namely Athletics, Dance, Gymnastics, Games, Outdoor and Adventurous activity and Swimming. All examining boards required the selection of 4-5 performance activities from three of these areas of activities. It is also worth noting that SEG (2000) made the selection of the “games” activity compulsory, in line with the National Curriculum. The WJEC, in addition to the selection of activities from three areas of activities, has retained its criteria for the selection of the four activities for the performance assessments namely;

- “Activity 1; Gymnastics or dance
  - Activity 2; An activity which demands the use of psychomotor skills in a competitive team game
  - Activity 3; An activity which demands the use of psychomotor skills in an individual or pair activity
  - Activity 4: A self-chosen activity not demonstrated under 1-3 above
- (WJEC, 1996, pg. 3; WJEC, 2000, pg. 5).

Three examining boards have slightly modified their names: MEG and OCEAC are both now known as OCR while ULEAC is known as EDEXCEL.

The activities offered for the year 2000 stood at 73, and this is higher than the amount of activities offered in 1997, implying that some activities have been added on. This could have been the result of the introduction of the six areas of activities. The activities offered for the purpose of performance assessment for each of the six areas of activities for 1998-2000 are presented in appendix 2.2. The amount of activities offered in each area of activities varied from one examining board to the other with outdoor and adventurous activities not being offered by SEG. Games got by far the highest number of activities offered by each examining board. There were quite a few activities offered by all examining boards some others exclusive to a limited number of examining boards. It must be noted that Judo was classified as a game activity (combat) by MEG and NEAB, while EDEXCEL classified it as a gymnastic activity. Waterpolo was also classified as a game (invasion) by NEAB, but EDEXCEL classified it as a swimming activity. The examining boards that offered most activities were NEAB, MEG and EDEXCEL who offered 34 – 43 activities

The new classification of physical activities can be recognised as an improvement on the variety of experiences for the pupils, however, in the coming years one needs to relate this to the physical potentials required for the high performance levels examined in the physical performance component of assessment. Scott (1997) commented that for many schools, finding a way to provide a course which enables the students to take at least three from the six areas of activities has been the major stumbling block and that the introduction of the Physical Education – (Games) syllabus was initially seen as “the answer to our prayers”. However, this syllabus also came with the three area “problem”, in particular in the striking/fielding/target games area as most schools would find difficulty facilitating the teaching of golf for example, while the selection of rounders instead of cricket is often based on which is the cheapest to offer! The physical and human resources requirements to offer an assessed course were found challenging, as noted by one examining board:

“the major change related to the choice of practical activities, which must be taken from three areas of the National Curriculum in the Full course has been generally welcomed..... The choice of activities is more restricted with the new syllabus and this has proved difficult for some centres”.  
(NEAB, 1998b, pg. 24, 28)

The kind of difficulty encountered is not specified and could relate to the pupil, the teachers’ competencies and the availability of resources.

It is not the scope of this discussion to go into further details in relation to the content (techniques, tactics, rules, etc) and cognitive domains (knowledge, application and analysis) of the activities, as prescribed by the GCSE and ‘A’ level PE syllabuses. Nevertheless, this would be an area worthy of investigation. The modes of assessing the practical performance coursework, including the demonstration of physical activities, unseen written papers, oral assessments the project work, the planning, performance and evaluation components have also experienced some changes for the sittings of 1998. The problems posed by these modes of assessment will be reviewed in the following section.

## **2.12 Modes of assessment of the coursework component**

In this section the modes used to assess the practical performance coursework of PE namely, performance, written and oral assessments will be discussed with reference to principles of assessments.

The modes of assessments of GCSE and ‘A’ level PE have been the subject of investigation of their development and implementation (Carroll, 1994), the different methods of assessment (Burgess, 1996), comparison of modes of assessments across examining boards (Cassar, 1995; Hodgson, 1996) and the analytic skills for analysis of performance (Latham and Cassidy, 1997). These studies have mainly described the requirements of GCSE and ‘A’ level PE syllabuses and

Carroll (1994) analysed the problematic nature of assessing the practical coursework. Further changes of the assessments of the coursework suggested in the practical performance syllabuses for 1998, merit further discussion and analysis. Reference will be made to the syllabuses, practical coursework guidelines, practical assessment handbooks, examination papers and chief examiners' reports of the various examining boards. It must be observed that the review of the chief examiners' reports has been a neglected area in the literature with reference to identifying and reporting the problems of assessments in PE.

The assessment objectives of GCSE PE prior to 1998 included physical performance, knowledge of safety relevant to physical activities and the acquisition of theoretical and practical knowledge and understanding of physical abilities (MEG 1997a, NEAB 1997, NICCEA 1997a, SEG 1997a, ULEAC 1997a, WJEC 1997, AEB 1997a, and OCEAC 1997). In GCSE PE syllabuses, assessment objectives also included cognitive abilities related to practical coursework such as:

- “describe and analyse through observation and/or performance the qualities (including aesthetic and creative elements) of specified physical activities
- show a knowledge of and ability to apply, the rules, tactics, conventions and etiquettes of specified physical activities

(SEG 1997a, pg. 1)

- “recall and apply facts, terminology, concepts and principles to show understanding of the syllabus content
- demonstrate the ability to observe, analyse, interpret and evaluate the performance of themselves and/or others”

(NICCEA 1997a, pg. 1)

While these objectives gave weighting to the cognitive skills of describing, analysing, observing, interpreting, recalling knowledge and evaluating, the assessment objectives stressed the importance of application and demonstration in a physical performance situation. The complexity of implementing assessment objectives emerged when one examined how these were translated into modes of assessments by the examining boards and the teachers.

The following discussion will focus on the problematic issues related to the modes of assessment adopted for the practical performance coursework. The issues under review include the nature of performance coursework assessments, the modes of assessing the performance coursework namely, the unseen written papers, video based unseen written papers, oral assessments, the observation and analysis components and project work.

### ***2.12.1 The problematic nature of performance assessments***

Performance assessments were carried out by the teachers and moderated by the examining boards. Teachers were supplied with written guidelines in the syllabuses and/or practical

performance assessment handbooks, which included more specific criteria for the assessment of performance coursework (WJEC, 1996; ULEAC, 1995b; EDEXCEL, 1998b, AEB, 1996a). Some examining boards also supplied videos (LEAG, 1992; SEG, 1996b; SEG, 1998c; AEB, 1997c) as exemplar models of assessments. The major problems associated with performance assessments were related to the administration and validity of these assessments with reference to the specified content of the syllabus and the assessment criteria, as will be elaborated in the following discussion.

The MEG syllabus (1997a) provided for the practical coursework assessment of three components:

1. Execution of technique (accuracy, adaptability, consistency, speed);
2. Selection of technique (tactical awareness of space, colleagues and opponents, awareness of playing conditions);
3. Effectiveness.

(MEG 1997b, pg. 79).

MEG defined “Effectiveness” as “the extent to which a candidate is able to integrate the execution and selection of technique”. The effectiveness was graded on a 5-point level with corresponding mark ranges. Level 1 was designated “Highly Effective” and Level 5 “Limitedly Effective”. An example of these levels is quoted from Netball in figure 2.4:

Figure 2.4: MEG: effectiveness assessment criteria.

Level	Description	Range of Marks
5	[Limitedly effective] Some ability to throw and catch, but not necessarily accurately. Limited appreciation of positioning and of the application of the obstruction rule.	0-3
4	[Partially effective] Ability to know and execute basic rules. Ability to pass the ball into space ahead of a colleague and to apply the footwork rule with a reasonable degree of success.	4-8
3	[Moderately effective] Knowledgeable about the rules, but less able to apply them. In consequence, less able to think quickly and hence the timing of a tactic becomes inaccurate. Has the ability and time to free oneself from an opponent and to find space.	9-18
2	[Effective] Ability to play strongly in an individual position. Knowledge of the tactics used in holding space. Effective use of these tactics in a game relative to one’s age group together with knowledge of rules and of their application.	19-26
1	[Highly effective] Ability to dominate an opponent whilst playing a competitive game at a high level relative to one’s age group. To show good reactions and produce a highly competent performance in a specialist position. Ability to fulfil positional requirements with flexibility to change roles depending upon a situation. Evidence of both an advanced knowledge of rules and of their application. An awareness of tactics and strategies necessary for successful team play.	27-35

(MEG 1997b, pg. 62)

The statements describing effectiveness referred to the knowledge and application of content items such as techniques of skills, tactics and rules, with reference to content items such as: “the obstruction rule – level 5”, “knowledge of tactics used in holding space – Level 2”. While these kinds of statements cover the areas of the subject content, they are not representative or exhaustive of the depth of the coursework content prescribed in the syllabus. Set plays and situations requiring candidates to apply other techniques, tactics and rules portraying the coursework content, accompanied by statements describing the levels of effectiveness would be more valid and relevant. Providing candidates with the opportunity to show what they know is a regular issue raised when assessing candidates in the competitive game situation.

The assessment of the practical performance of NEAB (2000) was graded on 8 levels. An example of the highest marking level is quoted below;

“The candidate is able to plan, perform and evaluate a comprehensive range of appropriate techniques and skills consistently and apply these in context in an effective and safe manner. The candidate has a thorough understanding of the rules/guidelines of the activity where applicable (22-25)”  
(NEAB 2000 pg. 78)

This statement includes reference to psychomotor (perform and apply) and cognitive (plan, evaluate, apply, understand) domains as well as aspects of content consistent with the prescribed syllabus content namely, techniques, rules and their application. It was observed that in the syllabus, one finds rules and umpiring listed as learning outcomes of each physical activity, however these were not particularly specified in the physical activities content of the syllabus (NEAB, 2000, pg. 17-72). This implies that rules, as a body of knowledge is somewhat taken fore granted. The statement in the examiners’ report that “the integration of the five marks previously awarded for knowledge of “Laws and Rules” was welcomed (by the teachers)” (NEAB, 1998b, pg. 28) further suggests that specific assessment on rules was camouflaged with that of techniques.

The SEG (1997a) provided detailed content and assessment criteria for each physical activity in the syllabus. For the practical assessment, the following four criteria were applied to each physical activity:

“A: Individual and Group skills  
B: Application of skills in the Game/Activity Situation  
C: Application of Rules and Regulations  
D: Evidence of Understanding of Quality of Performance”  
(SEG 1997a, pg. 9)

It is noted that both content and assessment criteria were organised according to these four assessment components. This kind of congruency between content and assessment made teaching and assessment easier to administer. It was also noted in the syllabus that for every physical activity the understanding of quality of performance could be achieved in a variety of ways

“ orally (question and answer, discussion, commentary); written; diagrammatically; by reference to a practical performance by a candidate, teacher, member of a group. This could also involve showing a film, photograph, posters”.  
(SEG, 1997a pg. 15 – 30; SEG 2000)

This suggestion gave a lot of freedom to the administration of this assessment and also made the teachers' role central in the development of assessments. However, one needs to question whether one mode is more valid and reliable than another especially with reference to specific performance/game situations of different groups of activities.

The exemplar videos for the practical performance provided examples of assessing specific abilities related to techniques in isolation and in a competitive situation (LEAC, 1992). The syllabus (ULEAC, 1997a) required of each activity to be assessed on individual skills that were described in the Physical Education Practical Assessment Guide (ULEAC, 1995b). An example of the assessment criteria for a selection of Netball skills is given in figure 2.5. The skills shown are footwork, defending and game situation performances. Other skills included in the performance assessments but not quoted in the figure were passing, catching, getting free and 3v3 situation. Thus, while the video provided examples of differentiation between candidates, the examining board modified the assessment of practical activities over the years rendering the use of this video (LEAC, 1992) to the application of bands of marks as not very useful.

NETBALL Performance	Levels						
	1	2	3	4	5	6	7
Footwork	Little evidence of correct footwork.	Able to demonstrate footwork rule correctly.	Demonstrate footwork rule whilst catching, including pivoting.	Demonstrates correct footwork including pivoting. Evidence of feet leaving ground to gain height.	Demonstrates correct footwork with strength. Agile movement about court.	Demonstrates correct footwork with strength and elevation when catching. Shows speed in movement around court.	Footwork faultless even in awkward receiving situations. Very fast movement about court.
Defending	Opponent easily gets free.	Opponent often gets free. Makes little effort to mark the ball.	Some success at marking initially but loses opponent. Some evidence of marking next pass.	Effective marking to delay receipt of pass by opponent. Evidence of marking ball for next pass.	Able to defend consistently well and then mark opponent's pass. Attempts marking of opponent's next movements.	Opponent finds difficulty in getting free. Marks opponent's pass and subsequent movement of opponent. Makes good use of peripheral vision.	High standard of marking. Opponent rarely able to receive a pass. Passes marked well and subsequent movement opportunities denied. Excellent use of peripheral vision to watch opponent and ball.
Game situation	Unable to influence game. Very limited contribution with skills not in evidence during play. Unable to comprehend changes in tactics or concepts of teamwork. Shows large degree of uncertainty.	Participates in game with limited effectiveness. Has difficulty performing basic skills in game situation.	Starts to become more effective in game situation. May exhibit some individual skills although they may be affected by pressure of game.	Plays effectively in game situation. Demonstrates good level of skill in chosen position.	Shows some ability to influence game either in attack or defence. Good command of skills and tactics in evidence even under pressure. Shows some anticipation of opposition and makes adjustments. Able to switch quickly from attack to defence.	Able to exert considerable influence on game in both attack and defence. Makes few unforced errors and assists team-mates. Shows high level of skill and tactical awareness even under pressure.	Exerts significant control over game. Shows outstanding level of skill, tactical awareness and anticipation, making very few unforced errors.

GAME PLAYED SLOWLY< .....>GAME PLAYED FAST  
(ULEAC 1995b, extracts from pg. 26-27).

Figure 2.5: Performance assessment of Netball.

The administration of the performance assessments improved over the years. Examiners reported that centres improved their approach to help candidates achieve a higher standard, “by improving assessment techniques and by generally organising the sessions in a much more structured way” (ULEAC, 1996a, note 4.2.1). However, in some cases there resulted disadvantages for the students since lengthy sessions placed unnecessary performance demands, forcing candidates to “perform to their best for up to one hour for each and every session”. The examiners advised that it was desirable to structure sessions so that a candidate “doesn’t perform for more than 25 minutes, thus allowing a candidate to perform to their potential”. It was also reported that the assessment of “evidence of tactical awareness” needed to be shown clearly in the sided games (ULEAC, 1996a, notes 4.2.1, 4.2.2, 4.2.3). Examiners reported that the selection of drills offered was not always appropriate to all levels of candidates who were demonstrating their skills. Some drills were not seen as sufficiently challenging and consequently candidates were rarely stretched or placed in situations that called for the tactical knowledge or techniques required for level 7 (ULEAC, 1997b, pg. 7 note 1.3). The examiners’ report noted that this needed more exploration “with the possible addition to the criteria of highlighted skills and practices to allow these skills to be seen” (ULEAC, 1997b, pg. 7 note 1.3).

For ‘A’ level PE, the assessment of the practical component carried a total weight of 30% of the total paper and the candidates were examined on five components for each of two physical activities namely:

1. Standardised Physical Preparation (a battery of fitness exercises)
2. Personal Performance
3. Demonstration of techniques
4. Written knowledge test
5. Observation, analysis of performance, identification and correction of faults in performance.

(AEB, 1996a, pg. 14-32)

The examining board provided an assessment handbook and advised teachers to apply the assessment criteria rigidly. They were also to provide evidence to support their assessments, including video recordings (AEB, 1996b, pg. 16). Video evidence of performance and demonstrations of a representative sample of candidates became compulsory for the sittings of 1997 onwards (AEB, 1997b pg. 16). This placed demands of accountability on the teachers.

The assessment of performance in competitive situations of males and females were reported to be in need of better organisation namely, males v males in basketball and females v females game. It was advised that the assessment of techniques should be marked against set criteria,

irrespective of gender, however, where gender tables were provided, candidates were to be assessed against that criteria (AEB, 1996b, pg. 17)

**2.12.2 Assessment through unseen written papers and oral assessments**

There were five examining boards (MEG, SEG, ULEAC, WJEC and AEB) who used unseen written papers for the assessment of the content and cognitive component of physical activities. All but one examining board (WJEC) discontinued the used of these papers for the sittings of 1998 onwards, with some others suggesting to teachers to set and organise their own modes of assessments. This posed a threat to the validity and reliability of these assessments. Nevertheless, the use of unseen written paper exhibited problems with the teaching and learning of the physical activities subject content, as reported by the examiners. Also, the papers were often not structured to cover a representative selection of the content and cognitive domains of the physical activities, as will be demonstrated in the following discussion.

The MEG utilised an unseen written paper, part of which assessed the knowledge related to classifications of physical activities in addition to performance assessments in four physical activities. The section “Analysis of classification of activities” included knowledge on the application of the term physical education as part of the educational process, and as an umbrella term covering sport families in the broadest sense. An example of part of a question from this section is quoted in figure 2.6 below:

Figure 2.6: Example of an exam question: MEG; Analysis and Classification of activities.

“Analysis and Classification Question 4 (e) Study the marks awarded below from a Diving Competition						
Competitor	Judge 1	Judge 2	Judge 3	Tariff	Total	Position
A	4.9	4.7	4.8	0.9		
B	4.9	4.9	4.9	0.7		
C	3.8	4.9	5.2	1.0		
<p>(i) On your answer paper complete the table giving the total marks for each competitor and their overall position [3]</p> <p>(ii) Why could awarding marks for interpretation be seen as an unfair method of marking such events? [5]</p>						

(MEG 1997c, pg. 4)

The other two sections “Theory and Practice of physical activities 1and 2”, each included questions on six physical activities. These are listed below;

“Activities I: Athletics, Gymnastics, Hockey, Netball, Rugby Union and Tennis;  
Activities II: Association football, Badminton, Basketball, Cricket, Dance, and Swimming”  
[MEG, 1997a, pg. 22, pg. 42].

Candidates were required to select one activity from each section, and given the options of this paper candidates who had been taught four physical activities for the performance assessment were assessed on one or two physical activities in the theory paper. An example of a question from Activities I: Netball and the corresponding marks are quoted in figure 2.7 below:

Figure 2.7: Example of an exam question: MEG; Netball.

“Question 8	
a) How many players are there in a netball team?	[1]
b) Name two players restricted to their defensive third of the court.	[2]
c) Describe the main points of the shooting technique.	[4]
d) Describe in detail how to perform a chest pass correctly.	[4]
e) What should the Wing Attack be aware of as the centre pass is taken?	[8]”

(MEG 1997c, pg. 7)

The content of the questions included: rules (a-b), techniques (c-d) and tactics (e) and the cognitive components assessed were mainly knowledge recall (a-d) and analysis and evaluation (e). Question e also included application. While the content was representative and distributed over a number of questions, the cognitive domains were not, and the higher cognitive skills were limited to one question only. The mark weighting allocated to the tactics question (e) was relatively high and an additional question would have been more just to the subject content and the candidates. It was also observed that MEG did not make use of diagrams in conjunction with the questions of the unseen written papers. The use of the unseen written paper was discontinued for the sitting of 1998 onwards.

The SEG also required candidates to answer questions on physical activities through unseen written paper. An example of an exam question is given in figure 2.8 below:

Figure 2.8: Example of an exam question: SEG Paper 2.

“Group 3 consists of the following physical activities: Athletics, Gymnastics, Movement (Dance/Educational Gymnastics), Swimming, Trampolining, and Weight-training / Weight- lifting,	
Answers to this question must refer only to these activities:	
3(a) For a named activity, or event:	
(i) state <b>one</b> simple technique and <b>one</b> advanced technique;	(2 marks)
(ii) describe fully how the simple technique should be performed;	(4 marks)
(iii) state the importance of correct technique and describe ways in which it can be improved.	(4 mark)
(b) Describe the different ways the following can help a performer.	
(i) A demonstration	(2 marks)
(ii) Video of their own performance	(2 marks)

(SEG 1997b, pg. 2)

SEG also operated an extended paper, which was aimed at differentiating between grades. An example of the questions for the activities of Group 3 of the extended paper is given figure 2.9;

Figure 2.9: Example of an exam question: SEG Extended paper 3.

3(a) For a named activity, or event give a detailed description of the warm-up to be performed immediately before the event or performance. Consider the following:	
(i) The body parts to be prepared	(2 marks)
(ii) The type of exercises needed	(4 marks)
(iii) The length of time it should take	(4 mark)
(b) For a named activity, or event state the training method or programme which would be appropriate to follow. Give a detailed description of your chosen method or programme.	(4 marks)
(c) For a named activity, or event explain how a coach/teacher/ trainer can help a performer with the following;	
(i) Mental Preparation	(2 marks)
(ii) Physical Preparation	(3 marks)

(SEG, 1997c, pg. 2)

From these two papers it can be observed that the first paper required lower level cognitive skills because the questions referred to knowledge recall and evaluation of physical activities *per se*. In the extended paper, candidates were asked to integrate and synthesise knowledge from the areas of health-related fitness with physical activities.

The use of the extended paper was a cause for concern. Examiners reported that there were many candidates entered for the extended paper who fared badly and did not seem to have sufficient knowledge to be capable of attaining grades A\*-C. (SEG, 1995, pg. 4, SEG 1996a, pg. 3). It was also reported by the examiners that when asked about “a physical quality” which could be used to the advantage of a performer, candidates confused physical quality (speed, endurance, etc) and instead “referred to particular shots or strokes” (SEG, 1997d, pg. 5). Why students were confused or could not grasp the context in relation to the “physical quality” in question could be explained by a variety of reasons. The use of the term “physical fitness qualities” on the part of the examiners would have probably made the question more clear to the candidates. On the part of the pupils, being thoroughly familiar with the use and application of physical fitness qualities during the practical coursework, e.g.: “Sera’s speed contributed to her being able to get free for a good pass” would help the candidates apply principles of fitness to physical activities and specific playing positions.

In other cases candidates were not able to clearly identify why knowledge of rules was important for the performing athlete, giving vague and superficial responses (SEG, 1995, pg. 4). Examiners also showed their concern when candidates were not able to describe an

attacking situation in a net/wall activity or to distinguish between *etiquette* and rules/laws (SEG, 1996a, pg. 3). Describing the correct technique for individual activities (athletics, gymnastics, movement, swimming, trampolining, weight training/ weight-lifting) was also reported as a poorly answered question. The examiners reported that this was “mainly due to the candidates lacking the analytic powers necessary to provide clear and concise responses” (SEG, 1996a, pg. 4). At this stage one should also question whether the techniques that candidates would have practised and perfected for the demonstration of performance assessment, were also addressed in writing.

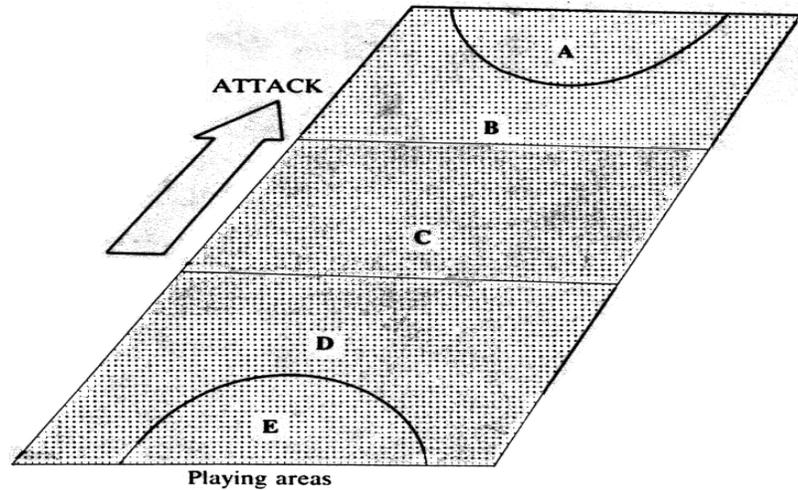
Moderators reported very consistent marking of the major games, however there were “great differences in less common games/activities, e.g. volleyball and weight training/lifting, where staff appeared to be either too severe or too lenient” (SEG, 1997d pg. 2). A point of concern was also raised on the high marks awarded to rounders, with teachers being reminded that “the emphasis should be on control and placement when striking and throwing rather than sheer power” (SEG, 1997d, pg. 2).

The SEG removed the use of the written paper from the assessment. However, it was interesting to note that the syllabus support material recommended the assessment of Skill Area C (Application of Rules and Regulations) “by means of officiating/judging a game performance and/or by means of a written test marked out of 10” (SEG 1998b, pg. 21). SEG also provided specimens for each physical activity in the support booklet (SEG 1998b, pg. 22-45). An example from Netball is quoted in figure 2.10:

Figure 2.10: Example of a specimen assessment for Application of Rules and Regulations: Netball, SEG.

“Skill Area C-Netball	
1. Study Diagram A of a netball court showing the playing areas of the attacking team	
A) Which player is only allowed in playing areas B & C?	(1)
B) Which player is only allowed in playing areas C, D, and E?	(1)
C) Explain the offside rule.	(3)
2. What action would the umpire take as a result of the following infringements?	
A) offside;	(1)
B) obstruction in the centre third;	(1)
C) contact by a defender against a shooter in the goal circle.	(1)
3. What is commonly known as playing the advantage rule?	(2)”

**Diagram A**



(SEG, 1998b, pg. 26)

The specimens included a series of questions, with diagrams. These questions were physical activity specific, similar to ones used by ULEAC (1996b) in relation to the more general questions applicable to a group of activities formerly used by SEG (1997b, 1997c). One should question why was this component removed from the unseen paper in the first place? Why were teachers in every centre expected to produce their own theoretical papers? It was also suggested by the examiners that “it is useful to make contacts with local schools to exchange test material” (SEG, 1998b, pg. 21).

The ULEAC also provided for the assessment of practical coursework through an unseen written paper. Candidates were expected to answer a series of lengthy questions on four physical activities. An example of a question from paper 2 is given in figure 2.11:

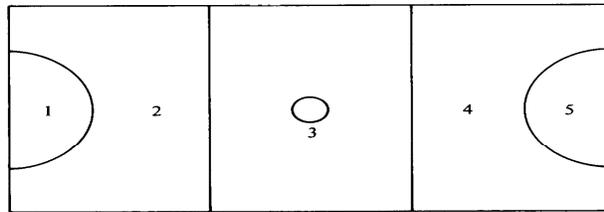
Figure 2.11: Example of an exam question: ULEAC Paper 2.

“Netball: Question A6.

(a) Using Figure 14 give the numbers of the areas in which the following players are allowed:

- i) Goal Shooter
- ii) Wing Attack
- iii) Centre

(3)



Direction of play

Fig 14

(b) A captain winning the toss will usually choose to have first centre pass.

Give two considerations which might make choice of ends preferable.

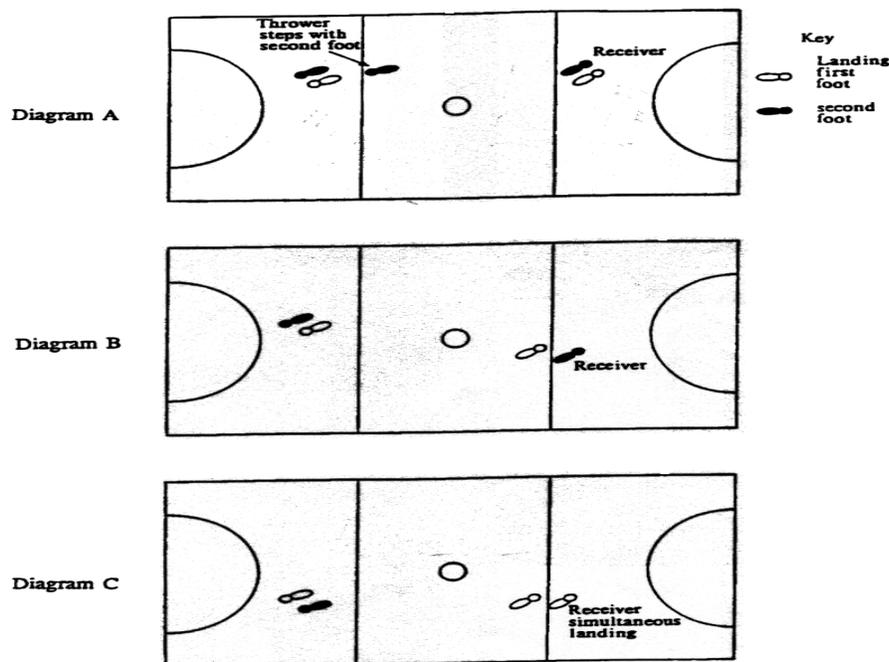
(2)

(c) State the correct umpiring decision when:

- i) a player throws the ball whilst sitting on the ground (1)
- ii) a player regains his/her balance by leaning on the ball within his/her allowed area (1)
- iii) a centre pass goes untouched over the side line of the centre third (1)

(d) Figure 15 shows the foot positions for passes A, B, and C. State **for each pass** whether the umpire should allow PLAY ON or WHISTLE for ‘thrown over a third’

(3)



(e) Give two occasions when an umpire will allow a “toss up”

(2)

(f) Explain, with the aid of a diagram, the tactic of screening

(3)

(g) Keeping the eyes on the target is one point of good technique for the standing shot. Give **four** other points of good technique for the standing shot.

(4)

(h) A defending player will attempt to prevent his/her opponents from receiving a pass.

(i) State two other aims of a defender

(2)

(ii) Give three points of good technique for the defender to prevent the opponent from receiving a pass

(3)

In the above questions one notices that content related to rules was present in questions a, c and e, while that related to techniques is covered in questions d and h. Question g required knowledge and application of a rule in conjunction with a technique. Tactics of the game were included in questions b, f and h. The cognitive components of these questions also covered a range of domains. Application of rules was evident in questions a and g, evaluation and analysis in questions b, d and e, while knowledge recall was necessary for answering questions c, f, g and h. From the series of questions one can observe that there was a high level of content validity as there was an adequate representation of both content and cognitive components.

It was reported that the candidates who tend to do best knew their sport thoroughly and were able to answer techniques questions in clear and concise terms (ULEAC, 1996a, note 2.2). The knowledge of rules/laws and tactical awareness was reported as slightly improved but there was still “lack of precision” in answers (ULEAC, 1996a note 2.3). The knowledge and understanding of terminology was reported to have improved, however the examiners reported that sport specific terms were not known/understood by many candidates. Amongst others these included: “Basketball Q.A1(e) “freezing the ball”; Badminton Q.B13(d) “triangular defence”; Table Tennis Q.B13(d) “expedite system” and Trampoline Q.C18(f) “Kip” (ULEAC, 1996a note 2.5). It was also reported that few candidates were aware of the application of the advantage rule in Netball (ULEAC, 1997b note 3.6). In the basketball question it was reported that candidates answered the question requiring a description of the 30 second rule imprecisely while the less knowledgeable candidates could not name and describe an attacking tactic (ULEAC, 1996a note 3.2). It was also reported that the signal for “Illegal use of hands” was not well known (ULEAC, 1997b note 3.2).

With regards to the quality of the answers examiners have repeatedly reported that candidates fail to read questions carefully, e.g. explain with the use of a diagram. Candidates were not allocated any marks if no diagram was presented, however the main shortcoming was from some candidates who did not use arrows to indicate direction of movement or passes in their diagrams (ULEAC, 1996a, note 2.4; ULEAC, 1997b, note. 2.4). The expected use of diagrammatic answers, while very relevant to the questions, needs to be considered from the pedagogical point of view. At this stage one needs to question whether visual demonstration and verbal explanations of tactical moves in the practical setting are adequate to prepare candidates to answer these type of questions.

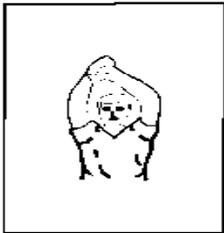
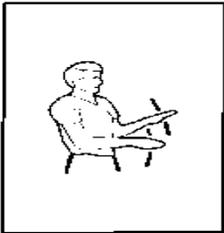
ULEAC used the unseen written paper on physical activities for the last time for the sitting of summer 1997. The examiners reported that this “well balanced paper ...will be missed”. They

also showed their concern and hopes that “much of the fine teaching” which this paper had brought the level of candidates to, “will be maintained” (ULEAC, 1997b note 2.9). It was also reported by the examiners that this paper “has developed and increased the depth of knowledge and understanding of the activities taken” (ULEAC, 1996a note 3.2; ULEAC, 1997b note 3.19). The removal of the unseen written paper on the assessment of four activities was substituted with the analysis and investigation of one activity! This method of assessment reduced the content and criterion validity of the five activities required for the practical performance situation. One can also question why was the unseen written paper removed?

The WJEC was the only examining board which retained the use of video based written paper (Paper 1) for dance or gymnastics and the question on the team games (Paper 2) (WJEC 2000 pg. 2).

The AEB operated a written knowledge paper that was constructed by the examining board, circulated in schools for teachers to copy, administer and mark. This paper was moderated by an external examiner. The examiners reported that the majority of centres conducted the “Written Knowledge Test” well, however, there were regular problems with administration and marking procedures (AEB, 1996b). Typical questions of the knowledge test are given in the figure 2.12

Figure 2.12: Example of an exam question: AEB, Basketball.

“ Basketball	
1. State the initials and full title of the international governing body of basketball.	[2]
2. Name two of the official position within the national governing body.	[2]
3. What information is being conveyed by the referee in the following diagrams?	[2]
 <b>A</b>	 <b>B</b>
4. When does a referee signal a “jump ball”? Give two examples	[2]
5. Physical fitness is made up of a number of components. Identify two of these components relevant to basketball and indicate one reason why each component is important.	[4]
6. Describe two coaching points for defensive rebounding	[2]
7. Describe two coaching points for the set shot	[2]
8. State two reasons why you might change from zone defence to a man-to-man defence system of play	[2]

(AEB, 1996c, pg. 20-22)

These questions covered content related to the physical activity *per se* (questions 3 and 4 on rules; 6 and 7 on technique; and 8 tactics,) as well as a combination of social issues (questions

1 and 2) and the application of knowledge of fitness to the physical activity (question 5). The content was representative, however, the cognitive domain of knowledge recall (questions 1, 2, 3, 6 and 7), was slightly over represented when compared to application of rules (questions 3 and 5) and analysis (questions 5 and 8). The use of the unseen written paper was last used for the sitting of 1997 (AEB, 1997b, pg. 16). With the changes of the Advanced Level GCE PE, the assessment of the practical coursework has been restructured and is now based on three components;

- a. The candidate's competence in a game/competitive performance situation
- b. The candidate's knowledge and understanding of performance through personal demonstration
- c. The candidate's knowledge and understanding of performance through Observation and Analysis, Identification and Correction of Faults and Synthesis of Theory and Practical.

(AEB, 2000, pg. 34-35)

AEB also provided specific assessment profiles for each of the 17 activities available for the assessment and each was organised according to the above three assessment strands. Stand C of this assessment was assessed orally. Teachers were expected to use open-ended questions, some of which were suggested in the syllabus (AEB, 1998a pg. 36, AEB 2000 pg. 36). Candidates were expected to observe both live and recorded performances. They were expected to exhibit knowledge of techniques and strategies, and understanding of rule structures and scoring systems of both their chosen activities. The examiners reported that candidates appeared to have had much more practice in the observation and analysis aspect, however, in the areas of fault correction and synthesis, where candidates were finding most difficulty, most centres tended to be over generous in their marks and centres were requested to do much more work in this area of the course (AEB, 1998b pg. 9-10). The impact of oral assessments on the validity and reliability of this form of administration and application of criteria of assessment is a cause of concern.

### ***2.12.3 The assessments of the analytic investigation and project work***

The assessment of the analytic investigation was introduced with the restructure of assessments for the examination sittings of 1998 onwards (OCR, SEG, EDEXCEL, NEAB, NICCEA, WJEC 1998-1999, 2000). This assessment was part of the performance coursework and was allocated 10% of the total mark by all GCSE PE examining boards, however, NEAB retained the use of the project work and awarded 20% of the total mark to this component. The problematic areas of these assessments included the lack of clarity of assessment objectives in relation to the modes of assessment recommended for both the cognitive skills and the physical activity content knowledge. In some cases this assessment was applied to one from the 4-5 activities of the performance coursework. There was also an inadequate

representation of content (techniques, tactics and rules) stated in the assessment criteria, replication of assessment through different modes (performance and oral) and the questionable validity of the mode(s) of assessment recommended.

The standardisation of assessment objectives of GCSE PE (MEG/OCR, SEG, EDEXCEL, NEAB, WJEC 1998-1999, 2000), endorsed the assessment of the candidate's abilities to demonstrate:

- “1. Physical performance, including the ability to interrelate planning, performance and evaluating whilst undertaking activity;
2. Analysis of improvement of their own and others performance;
3. Knowledge and understanding of ..... the advantages and risks associated with a range of training strategies and techniques.....”

NEAB (1996) required candidates to submit a personal study that included “a substantial element of practical involvement in physical activities”. Suggestions of the type of studies given as examples in the syllabus included:

- “ a. A detailed study of a recreation/leisure centre which would include how it is managed and organised, staffing, resources, facilities, financial administration and users.
- b. a study of one particular sport in an area, its organisation, participation and facilities
- e. a study of the effects of exercise on the heart rate. Collection of data from specific examples (self and others) and evaluation of results”(NEAB, 1997 pg. 17)

The personal study (NEAB, 1996) was assessed by the teacher according to the criteria supplied by the examining board which included research, analysis and evaluation and was moderated. Examiners described the project as a component which presented “the most demanding aspect of the overall assessment”, and the skills of “analysis and evaluation” continued to present a difficult hurdle particularly to the less able candidates (NEAB, 1996, pg. 20). How this was addressed in the teaching situation is not known, however, the structure of the components to be assessed were changed and the analytic investigation was assessed through the project (NEAB, 2000). The assessment of this component was divided equally between three criteria: planning and implementation, analysis and evaluation (NEAB, 2000, pg. 73) of one physical activity. The syllabus offered suggestions of the types of analytic investigation which would be suitable e.g.: “Basketball: practices to improve jump shooting and its effectiveness” (NEAB, 2000 pg. 73). It was expected that candidates would produce between 1,500-3,000 words. In addition to this assessment, the learning outcomes of each practical performance assessment included planning, performance and evaluation. This resulted in assessing the planning and evaluation cognitive components in duplicate, and leads one to question how these methods of assessment were facilitating representation of course content.

The OCR (2000a) included the assessment on planning, performance and evaluation of physical activities in the practical performance assessment while there was a separate assessment for the analysis and improving performance of self and others. The criteria for assessing the performance was integrated with planning and evaluating. Candidates were awarded marks according to the criteria described in each of five levels, with level 5 representing the lowest mark range (0-10) and level 1 representing the highest mark range (41-50). Level 1 for Athletics is being quoted in Figure 2.13:

Figure 2.13: Assessment criteria for the “Planning, Performance and Evaluation” component: OCR.

Level	Description	Marks
1	<p>A candidate will be able to demonstrate:</p> <ul style="list-style-type: none"> <li>• An ability to plan, carry out and evaluate, without supervision, an effective personal training schedule for selected events</li> <li>• An ability to achieve the following points total from three events (no more than two events from any group of running, jumping and throwing) using the AAA Five star Award Scheme tables: Boys 245 points, Girls 200 points</li> <li>• An ability to perform their chosen events with a high degree of skill</li> <li>• An ability to apply strategies/tactics based on sound judgements in his/her chosen events and to consider the outcomes</li> <li>• An ability to analyse technique in fine detail and make informed suggestions based on sound knowledge on how performance may be improved</li> <li>• An ability to plan, undertake and evaluate thoroughly a safe health-promoting exercise programme</li> </ul>	41-50

(OCR, 2000a pg. 25)

This assessment was aimed at measuring the candidates’ motor abilities while performing techniques of skills in a competitive situation as well as the application of tactics/strategies in the events. There was no mention of knowledge or application of rules in the assessment criteria, though the development and application of training schedules and exercises was included. The cognitive components assessed in the practical situation included evaluation, application, analysis, knowledge and synthesis (planning). It must be noted that the “planning, performance and evaluation” assessment included ‘analysis of technique and improvement’ even though there existed a specific assessment on “analysing and improving performance” as seen in figure 2.14. One can suggest that the “evaluation of technique” need not be assessed in duplicate. An example for assessing level 1 of the “Analysing and Improving” section is given in figure 2.14:

Figure 2.14: Assessment criteria for the “Analysing and Improving” component: OCR.

Level	Description	Marks
1	<p>A candidate will be able to demonstrate:</p> <ul style="list-style-type: none"> <li>• To recognise strengths and weaknesses in his/her own performance and others’ performance in fine details</li> <li>• To demonstrate a detailed knowledge of the methods and techniques which can be used to refine/modify subsequent attempts/practices in order for the performer to achieve success</li> <li>• To officiate/referee in a game/competition to a very good standard and with total authority</li> </ul>	9-10

(OCR, 2000a pg. 36)

This assessment was aimed at measuring the candidate's abilities to analyse and improve techniques and to apply rules in an officiating capacity. Teachers were free to choose their own method of recording this assessment including "a video taped recording or a written analysing/improving task" (OCR, 2000a, pg. 36). In the syllabus an example of analysing and improving task form was provided for a written assignment that "might be completed for homework" (OCR, 2000a, pg. 37). This exemplar task form included task instructions such as

"2. List in detail

- The strengths of the player/competitor/participant
- The weaknesses of the player/competitor/participant

3. Suggest ways in which any strengths or weaknesses may be improved or corrected"

(OCR, 2000a, pg. 38).

The suggestions of the examining board lead one to question the parity, reliability and the validity of these modes of assessment.

For NICCEA, candidates were examined on four physical activities for both individual performance and appraisal in an individual activity or game situation together with an evaluation of performance (NICCEA, 1997a, pg. 70). The criteria for evaluation was graded on abilities demonstrated during a practical session, however the examining board did not establish the actual content for the component of evaluation. With regards to the moderation of the evaluation component the examiners reported that

"most schools used some type of model to give the evaluation a structure and where this was used it seemed to help the candidate. In some cases it was pleasing to find evaluation techniques were less prescribed, with a reduction in the use of a variety of acronyms OFAST, OFASP, FASTPOR etc, that reflect little relevance to performance on the day. However, in others, key phrases appeared to be learned without any real understanding of their meaning to performance evaluation and these phrases were used indiscriminately." *Note, what these acronyms stood for was not disclosed in the examiner's report.* (NICCEA, 1997b, pg. 8)

This comment leads one to question how was this component being taught and how it could be improved such that the knowledge acquired through the performance situation and otherwise would be meaningfully evaluated by the students.

The knowledge and understanding assignment (SGPE), involved a series of problem solving tasks concerned with the application of skills, task management and evaluation (Stirling and Scott, 1989). The introduction of the investigation of performance (HGPE) was reported as being more demanding in relation to the skills and expertise required for the investigation (Forsyth, 1994). The need for producing detailed material for students for analysis of performance was seen as necessary since this component contributed to 40% of the final mark at HGPE. Nevertheless, Forsyth (1994) found that students coped well with the delivery of

the analysis of performance content through the practical in conjunction with frequent homework on one's own performance. The changes of the 1998 GCSE syllabus required pupils to analyse performance of themselves and others as an integral part of the practical element. The analysis of performance required the development of specific skills such as observation, comparison, evaluation and communication, which until recently had not been formally utilised in the assessment process (Latham and Cassidy, 1997).

In the case of AEB, the assessment of the observation and analysis component was also executed and marked by the teacher. Examiners felt that although the proficiency of the candidates' "observation/analysis/synthesis and correction was positive" there was evidence that the preparation of the students in this area was not adequate (AEB, 1995, pg. 18). Examiners reported that occasionally moderators provided supplementary questions, as there was evidence that candidates were not being asked open-ended questions, thus limiting the candidates' opportunity to show the extent of their knowledge. Right or wrong answers and specific questions were advised for use only if the candidate was not showing enough depth in their answers (AEB, 1996b, pg. 17). Examiners reported the same comments in the subsequent year and added that some candidates were being asked just technical analysis questions (AEB, 1997b pg. 17). The examiner acknowledged that "standardising questioning would possibly simplify the process" however they also felt that this was also problematic because "it could lead to very rigid and loaded questioning and answering by candidates who have been prepared in "parrot" like fashion" (AEB, 1997b, pg. 18). The examiners advised centres to refer to the syllabus and support material booklet and video for help in this area. This kind of criticism on the assessment of the analytic investigation component leads one to question the validity of the assessment given the administration and constructional problems identified by the examiners.

The individual project of the Sport Studies syllabus was assessed in a different method used by the other examining boards. The following nine components were sub-divided into specific skills, the number of which are indicated in brackets.

1. Planning (11)
  2. Support from relevant literature (9)
  3. Reporting method (3)
  4. Results (7)
  5. Discussion/ conclusion (7)
  6. Appraisal (2)
  7. Abstract (3)
  8. Bibliography (1)
  9. Communication (7)
- (AEB, 1998a pg. 121, AEB 2000 pg. 121)

In the syllabus one found the assessment administration procedure and criteria (AEB, 1998a pg. 121-125, AEB 2000 pg. 121-125) which involved answering a yes (= 1 mark) or a no (= 0 marks) to a series of questions addressing the skills of the nine assessment items. Some teachers annotated their projects with the number of the criteria in the candidate's work where it was felt the mark had been achieved. This made the moderation process easier (AEB 1998b pg. 10-11). Effectively, the examiners reported that although it was the first year (1998) that teachers were required to mark their own candidates, the marking scheme criteria appeared to be quite straightforward to administer. This assessment seemed very reliable for teachers to use.

This new assessment (1998-2000) of the analytic investigation of the coursework included restructuring and modifications to assessment criteria with an extension to planning, evaluation, analysis and improving performance all accomplished in a practical setting. This form of assessment is generic as far as the planning and evaluation of specific techniques, tactics and rules are concerned, however the cognitive domains are more pronounced. The modes of assessment recommended for the analytic component and the project work have decentralised the assessment and gave a more central role to the teacher. However, one needs to re-consider the fragmentation of the assessment components and the lack of depth of the content knowledge assessed. One also needs to question how are teachers preparing students for the assessment of the "evaluation" component in the performance setting and for the purpose of the analytic investigation. These issues bear some considerable weight on matters related to the validity and reliability of the assessments.

### **2.13 Summary**

In this second part of this chapter the description of the modes used for assessing the practical performance coursework of PE were described, together with the criteria provided for teachers to implement these assessments. From the examiners' reports and the evaluations of the modes of assessments with reference to the principles of assessments, it is evident that the assessment arena is complex and that there were no assessment structures that can be regarded as moderately to highly valid in terms of content, construct and criterion validity, except for written papers. The changes in assessments for the sittings of 1998 onwards included content (techniques, tactics, rules etc) and cognitive domains (planning, observation, application, analysis and evaluation) in all methods of assessments namely performance, oral and written based. What is also evident is that these assessment components need to be constructed by the teachers, without validation from the examining boards but subject to moderation. This is not contributing to more valid and reliable assessments as examiners have

reported that for both practical performance and evaluation and analysis components, the evidence of the component that is supposed to be examined (e.g. tactical awareness) is often missing. The suggested ways for collecting and recording evidence are left to the teacher, however, the use of authentic assessments in the form of portfolios and video recordings of one's performance is an aspect that merits more organisational consideration by the examining boards. The teacher's role in assessment is becoming more central at the expense of validity and variety of situations and this needs to be questioned with reference to the rationale of the examining boards for the justification of this shift of balance in power. Or is this a cost cutting strategy?

The utilisation of predefined assessment criteria has contributed to clarity in terms of what the examiner (teacher/moderator) is looking for. On scrutinising the criteria for both components of assessment (practical performance and analysis and investigation) it was often the case that certain components were assessed in duplicate without adequately representing the coursework content or a balance of techniques. The publication of videos in conjunction with predefined assessment criteria and tasks /situations to be used for the performance assessment have been forthcoming from some examining boards while others provided task sheets and model questions for the analytic investigation.

The number of activities required for assessment for the purpose of analytic investigation ranges from one physical activity accounting to 10% of the total mark (EDEXCEL) to five physical activities allocated 12% of the total mark (SEG), while one or more activities carry 20% of the total marks for NEAB. This leads one to question the content validity and the academic parity of these assessments.

This review has identified some of problematic areas of the performance coursework assessments, a selection of which will be investigated. Further depth of analysis of the publications of examining boards (syllabuses, assessment handbooks, examiners' reports, assessment papers and marking schemes) is recommended such that issues related to methods and constructs of assessments of activities from different classifications of activities can be evaluated with reference to the principles of assessments. More interestingly, ethnographic investigations on the pedagogy of the coursework content of GCSE and 'A' level PE, with reference to modes of assessments is suggested such that the teaching-learning and assessment link will be fully explored.

## 2.14 Research issues

This review has provided more focus on issues related to the teaching and assessment of the practical performance coursework of GCSE and 'A' level PE. The following research issues attempt to investigate the link between the teaching and assessment of the content and cognitive components of physical education coursework.

1. Does the use of teaching resources such as handouts, in addition to the practical performance teaching environment facilitate learning?
2. Does teaching the content (techniques, tactics, rules, safety measures etc) in a practical performance teaching situation adequately prepare students for oral, video based and written assessments for the coursework content?
3. Is the integration of the content and cognitive component of the practical performance content in a class-based as opposed to a performance based teaching situation providing more opportunities for students to "know and understand" and communicate their knowledge orally and in writing?
4. What is the impact of the teaching environment (performance based vs. class-based) on the process of transformation of knowledge of content and cognitive domains of athletic type activities (e.g. athletics and swimming) and game type activities (e.g. ball games: netball; racquet games: tennis; combat games: judo; target games: golf)?
5. Does the teaching context (performance based vs. class-based) have any impact on the assessment of any of the content and cognitive domains?
6. What is a more valid way to assess the content and cognitive components of physical education coursework?
7. What do students think about oral, written and video based assessments?

These questions formed the structure of a study aimed at investigating the teaching of selected content and cognitive components of two physical activities from two classifications (i.e. athletic and game type). Each of these activities was subjected to three experimental teaching conditions and two methods of assessment. The methodology used for this study is described in the following chapter.

## CHAPTER 3

### METHODOLOGY

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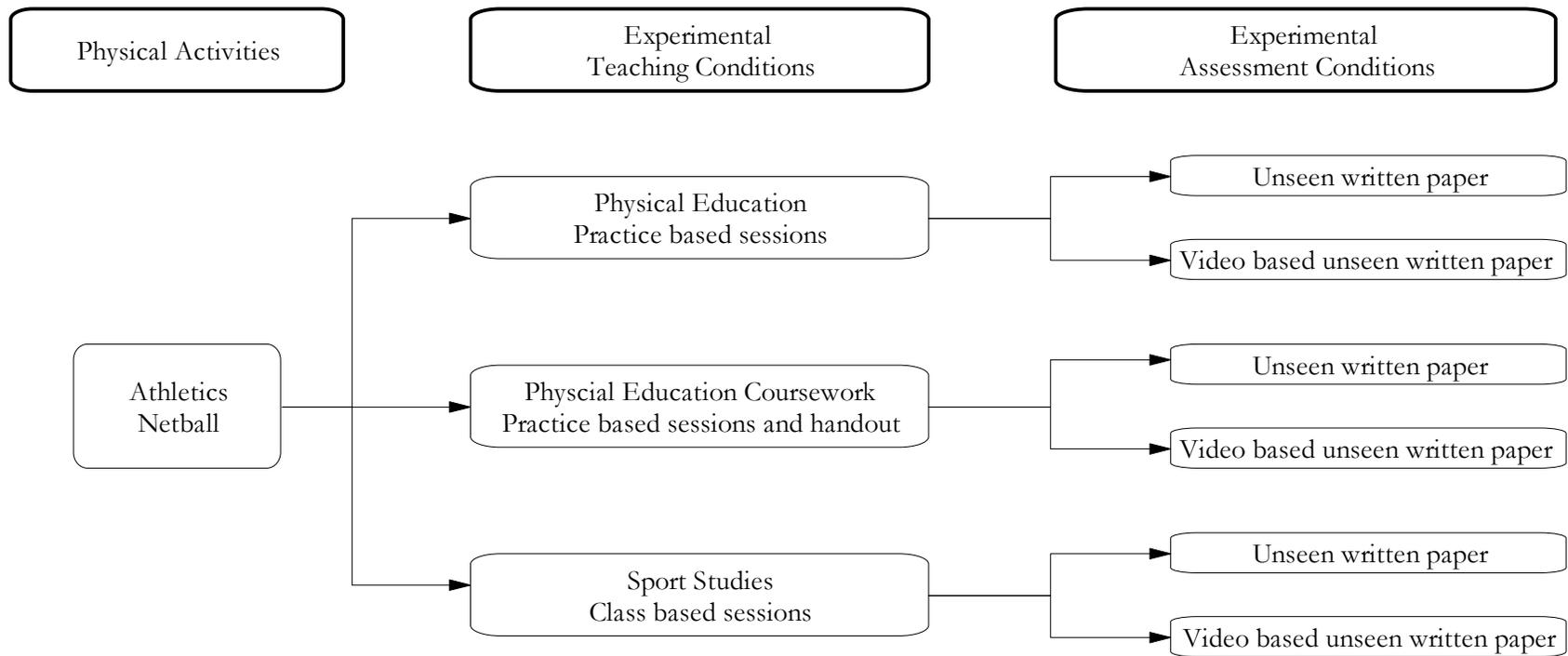
#### 3.1 Introduction

This research consists of two related but distinct studies set within the theoretical contexts of teaching and assessing GCSE and 'A' level PE at 16+ and 18+. The first study is focused on experimental teaching units (ETUs) for teaching two physical activities; one from the game family of competitive activities – Netball, and the other from the athletic family of competitive activities – Athletics. Each of these activities were taught utilising three experimental teaching conditions. The first condition was teaching in the practical setting (gym/court), the second was similar to the first, however, at the end of each session, a handout including diagrams/picture illustrations and the main teaching points of the session was discussed and given to subjects to take away. The third condition was teaching in a class-based environment using discussions, expositions, video clips, handouts and written classwork. The teaching and assessment objectives of each activity were applicable to the three teaching conditions. This study had a quasi-experimental design. The major aims of this first study were to quantify and identify any differences between the teacher's and pupils' verbal and non-verbal behaviours and the time spent on content in the three teaching environments and the two physical activities. The ETUs were recorded on video and a systematic observation system (CAFIAS) was employed to analyse the experimental teaching conditions.

The focus of the second interrelated study was on the measure of learning gains in relation to the experimental teaching conditions and the physical activities. This study also investigated the impact of the experimental teaching conditions on the learning gains with respect to two domains: subject content (techniques, tactics and rules) and cognitive components (knowledge, application and evaluation). Two experimental assessment conditions were used to measure the learning gains from pre-test to post-test phases, these were an unseen written paper with diagrams (W.P.), and a video based unseen written paper (V.P.).

A summary of the experimental design is presented in figure 3.1.

Figure 3.1: A summary of the Experimental Design.



The research was conducted within the theoretical contexts of emergent theories on instructional design for teaching PE (Vickers, 1990), teaching for understanding (Thorpe and Bunker, 1986) and assessing PE (Carroll, 1994). This research questioned the “practical environment” inherent of National Curriculum and recreational PE for teaching the content and cognitive domains of physical activities for assessed courses. It also questioned the validity and reliability of the modes of assessments in relation to the teaching environments.

### **3.2 Population**

The 16+ and the 18+ examinations in Malta took a change of course in 1996, when the Matriculation Certificate Examination offered by the MATSEC Board taken at 18+ became the pre-requisite for university entrance (MATSEC, 1994). This change in examination course structure created an opportunity for PE to be offered at Intermediate Level (Ventura, 1997) in pre-university courses offered by Sixth-Form Colleges, Junior College and Higher Secondary Schools (Zammit Ciantar, 1996). The courses were of two-year duration.

There were seven educational institutions offering pre-university courses in Malta. Three were maintained by the government, three run by private/church schools and one was under the auspices of the university. The criteria for entrance in these colleges was six SEC subjects or equivalent, although the Higher Secondary Schools and the private/church colleges accepted students with less than six passes and offered intermediate help.

A meeting between the researcher and the head of school and the head of PE was organised in each of these schools to explain the nature of the research project. The points discussed included the possibility of taking intact classes or recruited groups for a series of weekly PE sessions totalling 8 hours. The basic resources that were required for implementing the research project included a gym or track for athletics and a netball or volleyball court and goal posts for netball. The availability of a class with video viewing facilities for pre and post-testing and for the series of sessions of one teaching condition was also discussed. The possibility of awarding a certificate of attendance to the subjects was considered. An invitation for PE teachers to deliver the series of sessions with the full support (training and supply of scheme of work and lesson notes) of the researcher was also suggested. The researcher sought permission from the head of schools to record the lessons on video and ensured full confidentiality of the use of these videos for research purposes. The researcher also guaranteed confidentiality to the name of schools and the subjects. The schools were also informed about the time schedule of the pilot study (February – April 1997) and the experimental teaching (September –December 1997).

Following the meetings, three of these schools showed genuine interest and accepted the invitation to be involved and offered all their support right away. Two schools replied in writing that they did not find the project feasible. One vocational school (technical subjects) that shared the sports facilities with a sixth-form college offered time tabled PE lessons for first year students. Since the students' entry age (16+) and qualification requirements to the vocational school were similar to the other pre-university sector (Zammit Ciantar, 1996) it was decided to include this school in the main study. One school was dropped from the project due to the lack of adequate sports facilities for netball or athletics.

The total population of students in the seven institutions was acquired through requesting heads of schools to fill in an information sheet (see appendix 3.1) following the briefing meeting and through the provision of information from the Education Division. The total school population of these pre-university institutions for the scholastic years 1995-96 was 3,812, including 1,857 females and 1,955 males.

### **3.3 Sample**

There were four schools selected for the study, one of which was only involved at piloting stage. These schools were geographically located over the two main inhabited islands of the Maltese archipelago. The inclusion of a highly representative sample of schools from the pre-university level was taken as a measure to reduce the threats to the external validity of the study (Cohen and Manion, 1994, pg. 171)

The selection of schools, teachers and subjects for this study largely depended on the acceptance of the proposed research project by the schools, a choice made by the head of school and the PE teachers. Other criteria included the availability of basic and safe physical resources required. The recruitment of the pupils and the teachers for both the pilot study and the main study will be discussed in the following section. Details of the pilot study are given at the end of this chapter. It was felt appropriate to state the sampling procedures of the pilot study at this stage because the unanticipated problems of recruitment led to a slight alteration of the experimental design and the changes are better discussed at this phase.

Teachers were invited to be involved in both the pilot and main study and there was one teacher who volunteered to deliver one of the nine ETUs of the main study. There were 10 subjects who completed the entire experimental treatment at piloting phase and 97 subjects who finished the ETUs of the main study.

### 3.3.1 The pupils

#### 3.3.1.1 Recruitment for the Pilot Study

Subjects for the pilot study were recruited on a voluntary basis after meetings were held with students in their respective schools. This was followed up with working in close collaboration with the PE contact teachers in each school. The sessions in School A were offered to first year students only, on the advice of the head of school. These were time-tabled sports sessions, where students were expected to enrol on a sports activity of their own choice, of which netball and athletics were part for the second term. A notice, giving details of the schedule of activities was put up on the school's sport notice board (see appendix 3.2). Subjects enlisted for the activities were not informed about the teaching conditions. Given the number of students who signed up, it was feasible to form two netball classes. Subjects were randomly assigned to the teaching conditions. In School B, PE or sports sessions were not time tabled and students interested in getting enrolled had to fill in a form, indicating the hours available on their weekly time-table (see appendix 3.3). These forms were left with the contact PE teacher. In this school the researcher organised two meetings with the applicants, and followed up those who could not attend by phone. There was a serious feasibility problem in school B, which had not been anticipated. Finding a common time resulted in having to drop some students. A letter of notification of the start of course was sent to the applicants at home (see appendix 3.4).

It was planned that the pilot study would cover three physical activities (athletics, gymnastics and netball) and that three teaching conditions would be assigned to each activity. The experimental teaching conditions (ETUs) were; ETU 1: practice-based teaching; ETU 2: practice-based teaching and handout; and ETU 3: class-based sessions including the use of discussions, video clips, handouts and written classwork. Each subject was to undergo three experimental assessment conditions, namely, unseen written paper with diagrams, video based unseen written paper and an oral assessment. However, the number of self-recruiting students was surprisingly low in both schools and only the game activity, netball was feasible to implement for the pilot study. The number of subjects recruited in each group was as follows: seventeen for ETU 1, ten for ETU 2, and seven for ETU 3. The table below provides details of the gender and the schools from where the subjects were recruited.

Table 3.1: Netball Pilot Study: Subjects by school and gender

School	ETU 1 <i>practice-based teaching</i>		ETU 2 <i>practice-based teaching and handout</i>		ETU 3 <i>class-based sessions</i>	
	Female	Male	Female	Male	Female	Male
School A	11	6	6	4	Not Recruited	
School B	Not recruited		Not recruited		6	1
<b>TOTAL</b>	<b>17</b>		<b>10</b>		<b>7</b>	

Implementing the pilot study in the second term was met with a number of technical problems that resulted in students not completing the experimental treatment. In School A, the social and extra-curricular events were in their final stages and the sports time was used for scheduled rehearsals and for training sessions of the school's teams. This led to subjects missing sessions, consequently there were three subjects from seventeen who attended all the sessions, the pre and post-tests for ETU 1 and six subjects from ten for ETU 2. Second year students in school B had their mock exams in March and were not required to go to school thereafter. Exams leading to a university entrance qualification started in mid-April, at the time the ETUs were implemented and when the subjects were contacted by phone most preferred to stay studying at home. This meant that one subject from seven finished all the sessions for ETU 3.

The pilot study highlighted the possibility of implementation problems, namely, a lack of recruitment of teachers to deliver the ETUs and subjects not completing all the sessions. Following the technical problems of the pilot study, it was decided to take the following measures to address the teacher's recruitment problem and to attempt to motivate subjects to attend the classes:

1. PE teachers in sixth-form colleges where the ETUs were taking place were still to be encouraged to take on the classes and be provided with training and teaching documentation. Failing that, the researcher would take the classes.
2. Subjects were to be better informed about the courses without specifying the teaching conditions. This was necessary to reduce one source of threat to external validity (Hawthorne effect) as subjects would realise their role and the experimental treatments will be contaminated (Cohen and Manion, 1994). The information sheets advertising the ETUs included assigning different names to represent the three experimental teaching conditions, namely:

- ◆ **Physical Education:** Netball / Athletics; (*ETU 1: Practice-based teaching*)

- ◆ **Physical Education Coursework:** Netball/Athletics; (*ETU 2: practice-based teaching and handout*)

- ◆ **Sport Studies:** Netball / Athletics; (*ETU 3: class-based sessions*)

A brief description of the course structure, content and duration was provided in the information sheet to be put up on notice boards of the schools where the respective courses were offered. All information sheets advertising these courses included an identical endorsement to whom the course was suitable, and a note that a certificate of attendance will be awarded (see appendix 3.5).

3. Implementation of the ETUs was to be initiated in the first term so that students felt that it is part of the school programme.

#### *3.3.1.2 Recruitment for the main study*

For the actual study, which was implemented between September and December 1997, there were nine classes from three schools. The experimental teaching period was kept to one term to reduce threats to the internal validity of the study, namely, history, maturity; statistical regression and experimental mortality. The randomisation of the experimental teaching conditions also reduces threats (Thomas and Nelson, 1995). History and maturity occurs when subjects change over the treatment period and can produce differences that are independent of the experimental treatments. Statistical regression refers to the incidence of subjects getting high scores at pre-test and regress and get lower scores at post-test and vice versa, and experimental mortality takes place when subjects drop from the experiments having a confounding effect on the variables (Cohen and Manion, 1994).

Precaution was taken to have the experimental groups equivalent in the factors that may effect the dependent variable. One method used to equate the differences as suggested in educational research was random assignment of subjects to experimental teaching conditions and random assignment of experimental treatments to selected groups (Verma and Mallick, 1999, pg. 98). Thus, the assignment of the experimental teaching conditions was done at random. From the three schools involved in experimental teaching, subjects from School 1 were given the options to enrol for either Physical Education: Netball or Physical Education: Athletics, however the subjects were not aware of the experimental teaching treatment. In Schools 2 and 3 intact classes that had PE lessons on their time-table were assigned to the two physical activities and teaching conditions at random. Cohen and Manion (1994, pg. 170) warn about the threats to internal validity caused by selecting intact classes, however, the feasibility of random assignment of subjects to the experimental teaching conditions did not prove feasible for this study.

The numbers of subjects in the Netball and Athletics experimental teaching groups are given in tables 3.2 and 3.3. The tables include the number of the subjects at the start of the study, the number of those who were dropped for technical reasons, the number of those who missed one session and those who completed the entire experimental treatment. The subjects who attended all sessions and missed one session were considered satisfying attendance criteria and were retained for the purpose of analysis of the study.

Table 3.2: Sample of Athletics experimental teaching units as per teaching conditions.

ATHLETICS	<i>ETU: A1 Physical Education</i>		<i>ETU: A2 Physical Education Coursework</i>		<i>ETU: A3 Sport Studies</i>
	<i>School 1: Class 1</i>	<i>School 3: Class 2</i>	<i>School 3: Class 3</i>	<i>School 2: Class 4</i>	<i>School 2: Class 5</i>
Number at start	6	20	22	24	19
Technical drop outs	4	10	10	12	8
Missed one session	2	3	3	4	3
Attended all sessions	0	7	9	9	9
Subjects satisfying attendance criteria	2	10	12	13	12
Total Subjects in teaching condition	12		25		12

Table 3.3: Sample of Netball experimental teaching units as per teaching conditions.

NETBALL	<i>ETU: N1 Physical Education</i>		<i>ETU: N2 Physical Education Coursework</i>	<i>ETU: N3 Sport Studies</i>
	<i>School 1: Class 1</i>	<i>School 2: Class 2</i>	<i>School 2: Class 3</i>	<i>School 2: Class 4</i>
Number at start	11	13	21	20
Technical drop outs	0	4	9	4
Missed one session	3	6	3	5
Attended all sessions	8	3	9	11
Subjects satisfying attendance criteria	11	9	12	16
Total Subjects in teaching condition	20		12	16

The number of subjects listed at start included those who did the pre-tests and filled the information sheet (see appendix 3.6) on the first day of the sessions. The students who were dropped from the study for technical reasons, included those whose classes were either changed after the first couple of weeks at school due to clashes on the time-table, or those who changed subject options. This resulted in a number of students who joined a different class and never came to the sessions again and others who joined the sessions after the ETU had started. Students who missed more than one session or did not complete the pre-tests and post-tests were also dropped from the analysis. It was decided to include subjects who missed one teaching session during the experimental teaching because the major teaching points of the previous session were regularly consolidated in subsequent sessions.

### 3.3.2 Teachers

In all three schools, a PE contact teacher was appointed to liaise with the researcher. These teachers were available to help co-ordinate the sessions and the researcher delivered the ETUs. It must also be noted that the researcher observed that PE sessions in sixth-form colleges tended to be either coaching sessions or a recreational activity where the teacher organised groups into fitness classes, game activities, leisure activities, supplied and collected

equipment, umpired, coached and checked attendance. In some schools, coaches and fitness instructors were hired to deliver the sessions.

One teacher volunteered to deliver the ETU of athletics offered on the sports activities programme of the school. The teacher did not find any problems with delivering Physical Education-Athletics: ETU 1 (A1- Class 1). This teaching condition had been assigned to that particular school before the teacher came up with the initiative. This teacher had followed a B.Ed (Hons.) course and PE was one of the two main teaching areas. The teacher had been teaching PE for four years to Forms 1-5 in the secondary school and the Sixth-form College of the same school. As for athletic activities, the teacher taught running events (short and long distance and hurdles), throwing events (shot, discus and javelin), and jumping events (long, triple and high). The teacher was the coach for the schools' athletics teams and also coached athletics at club level outside the school. The age of the athletes within the responsibility of this teacher-coach were 12-21 and they competed at national and international level. The teacher had also attended the IAAF (International Amateur Athletics Federation) Olympic Solidarity Basic and Level I athletics coaching courses of approximately two weeks duration each and a ten hour athletics officiating course organised by the MAAA (Malta Amateur Athletics Association).

The training of the teacher for the delivery of the ETU was done at the school of the teacher. The teacher was supplied with the scheme of work, lesson notes, and athletics equipment to deliver the sessions. The researcher and the teacher met weekly to discuss and clarify each lesson, in particular the organisation of the lesson activities and the teaching points, and to report on the previous lesson note. The pre and post-tests documents and their marking schemes were also given to the teacher to provide a background of what students were expected to achieve in writing at the end of the course. The teacher fully respected and appreciated that adherence to the lesson note was paramount to reduce the threats to the validity and the reliability of the study. The teacher also accepted that the lessons of the ETU were to be filmed.

The researcher delivered the ETUs of the remaining eight classes. The researcher's teaching experience included two years of teaching secondary school PE to Form 1-4 students. The researcher was the schools' coach for the juniors' and seniors' netball teams and for coaching shot putting (junior and seniors) for the Inter School's Annual Athletics Meeting. The researcher also taught for another three years in a sixth-form college (2 hours a week), teaching and umpiring netball for improves and tennis for beginners. The researcher attended three netball coaching courses and one umpiring course of approximately one-week duration

each, organised by the MNA (Malta Netball Association) and delivered by experts from the BNA (British Netball Association). The researcher also attended a two weeks coaching course in athletics organised by IAAF Olympic solidarity. Further to these, a five day in-service course on teaching GCSE and 'A' level PE and Sport Studies, organised by the British Association of Advisers and Lecturers in Physical Education (BAALPE) was attended. The researcher also had all the lessons of the ETUs filmed.

### **3.4 The Experimental Design**

The rationale of the selection of classifications of activities and the representative physical activities for the ETUs will be discussed in this section. The reasoning of the choice of the objectives and the content of the ETUs and their validation will also be presented together with the development of the teaching documentation of the ETUs. The filming of the ETUs and the systematic observation techniques considered for analysing the ETUs will also be discussed.

The experimental design included experimental teaching of two physical activities coming from two different families of competitive sports activities: Game type: Netball; and Athletic type: Athletics. Both of these activities were part of the GCSE PE syllabuses (1994-1998). Athletics had been part of Advanced Level GCE since 1996 (AEB 1996a, OCEAC 1996) while Netball was first offered at this level in 1998. Selected content of these activities (techniques, tactics, rules and umpiring) and cognitive skills (knowledge recall and comprehension, application and analysis and synthesis and evaluation) (Bloom, 1956)) were adopted for the content of the ETUs and taught to 16-17 year olds. The ETUs included five hours of teaching for each of the experimental teaching conditions of Netball and six hours of teaching for the experimental teaching conditions of athletics. In addition, each subject was administered two tests (unseen written paper and video based unseen written paper) before and after the experimental treatment.

#### ***3.4.1 The experimental teaching units (ETUs)***

The construction of the ETUs involved the selection of physical activities and the teaching conditions. It was also the aim of this research to investigate whether specific types of classification of activities lend themselves better to particular ETUs and modes of assessment. The impact of the teaching condition on the mode of assessing the content (techniques, tactics, rules and umpiring) and cognitive domains (knowledge and comprehension, application and analysis and synthesis and evaluation) was also of major interest for the study.

The selection of activities for this study involved the deliberation of the following issues:

- ◆ Activities representing a group/family of activities
- ◆ Activities that were part of GCSE and 'A' level PE syllabuses

◆ Activities that were practised in Maltese schools

The rationale for selecting “representative” activities was based on a consideration of curricular frameworks of National Curriculum Syllabuses of Malta, and England and Wales, as well as on the organisation of activities in GCSE and ‘A’ level PE Syllabuses (pre-1998) and on the descriptions of competitive families of activities.

The areas of activities of the National PE Syllabus for Secondary Schools of Malta (Education Department, 1992) included an engendered activity-based classification of activities grouped in four areas. These are presented below:

1. Gymnastics including Games of Low Organisation and Athletic Activity: (*modern educational gymnastics, agilities, vaulting, displays, rhythm (girls only), fitness; running, jumping, throwing, skills through lead-up games*)
  2. Team Sports (*fielding, court/net: volleyball, court/invasion: basketball, football (boys only), handball, hockey (boys only), netball (girls only)*)
  3. Individual Sports (*badminton, lawn tennis*)
  4. Rhythm and Dancing (*square and folk dancing, creative dance (largely for girls)*).
- (Van Vuuren-Cassar, 1998).

There is not a National Syllabus of PE for 16-18 educational sector in Malta. However, Legal Notice Number 56: Post-Secondary Level (National Minimum Curriculum (Malta), 1991), which is a legal document, set the minimum requirements for schools operating at this level. In this document it was stipulated that two of the objectives at this educational level are to achieve “a realisation of the importance of keeping physically fit and maintaining mental balance” and an “active promotion of the good use of leisure time by instilling in each student enthusiasm for a sporting activity as well as for other positive pursuits”. Thus, fitness and leisure activities was what PE at this level was technically about.

The six areas of activities of the National Curriculum for England and Wales (1995) were athletics, dance, games, gymnastics, outdoor pursuits and swimming. As from the sittings of 1998, the structure of the classification of activities of GCSE PE assessed incorporated these streams. Since the study was addressing the 16+-age group the classification of ‘A’ level PE syllabuses were also considered. The areas of activities were two, individual activities and team games for both AEB (1996a) and OCEAC (1996). The structure of the competitive family of activities comprised three branches: athletic type, game type and gymnastic type (AEB, 1990). Each of these branches are briefly described below

- Athletic type activities: In these activities judging procedures seek to determine a winner who will produce more power than anyone else (higher, faster, stronger). These activities are also called Power Optimisation (PO) activities. Examples of activities in this classification include swim racing, ski racing, field and track athletics, rowing and weight lifting.

- Game type activities: The scoring procedures of these activities determine which team/player achieves the highest amount of goals, runs, touch-downs, target points etc. Strategies for winning include outwitting opponents, dominating territory and scoring. Thus, winning in these activities largely depends on Coincidence, Anticipation and Avoidance (CAA). These type of activities include ball games (e.g. netball, water polo, baseball, hockey); racquet games (e.g. squash, badminton); combat games (judo, boxing, wrestling) and target games (archery, shooting, darts, golf)
- Gymnastic type activities: movements are judged against a pre set theoretical model/criteria (e.g. the BAGA code of points) and winning is the result of “the best” in qualitative terms, replication of movement. These activities are also described as movement replication activities. Activities in this group include artistic gymnastics, rhythmic gymnastics, diving, and trampolining.

The following table gives the areas of the classifications of activities considered for this study:

Table 3.4: Classifications of physical activities for the Secondary Schooling and 16+ Physical Education.

<i>Maltese National Physical Education Syllabus (Education Department, 1992)</i>	<i>Legal Notice for post-secondary education in Malta (NMC (Malta), 1991)</i>	<i>National Curriculum of Physical Education for England and Wales (1995)/ GCSE Physical Education Syllabuses (post 1998)</i>	<i>Advanced Level Physical Education (1996)</i>	<i>Competitive family of activities. (AEB, 1990)</i>
1. Gymnastics and games of low organisation and athletic activity 2. Team sports 3. Individual sports 4. Rhythm and dancing	1. Fitness activities 2. Leisure activities	1. Athletics 2. Dance 3. Games 4. Gymnastics 5. Outdoor Pursuits 6. Swimming	1. Individual Activities <sup>1</sup> 2. Game Activities	1. Athletic type 2. Game type 3. Gymnastic type

<sup>1</sup> Includes Athletics and Gymnastics

From the table it is evident that the most common activities across these classifications were: Game type activities/team sports (4 instances), Athletics type activities / individual activities (4 instances) and Gymnastics (4 instances). Ideally, it would have been most revealing to sample a physical activity from each of the classifications in the above table, and an attempt to sample three activities from each of the most common classifications of activities did not prove feasible at pilot study stage due to the problem of recruiting subjects. Thus, it was decided to include the most feasible classifications for the main study, game type and athletic type.

The next step was to determine which physical activity to choose for the study. Athletics was an automatic choice from the athletic/individual type of activities since swimming and gymnastics were hardly practised at post-secondary school level in Malta (personal communication with PE

teachers in seven post-secondary colleges). The team game required more thought as mixed basketball and volleyball leagues were very popular in most colleges and having less teams in the league because some students would be on the ETUs for the first eight weeks of term was not a welcomed idea by the teachers. Thus, a passing team game, was selected. After checking the availability of equipment (courts and goal posts) in schools, it was decided to select netball as the game type activity.

The three experimental teaching conditions were decided following a consideration of the advice of the examiners' reports to have candidates applying analysis and performance of self and others during the practical sessions (AEB, 1997b) and class-based lessons for teaching the knowledge component (MEG, 1993). From interviews with teachers teaching GCSE PE in England (Cassar, 1994), it also transpired that teachers gave handouts consolidating knowledge on techniques, tactics and rules to pupils following practical sessions and follow up homework sheets. Thus the experimental teaching conditions for each of the two activities were:

1. ***ETU 1: Physical Education (Netball-N1/Athletics-A1)***: practical class similar to the practical National Curriculum PE lesson. Subjects were not to be given any handouts. The emphasis was on teaching the content and cognitive domains.
2. ***ETU 2: Physical Education Coursework (Netball-N2/Athletics-A2)***: practical class, exactly like ETU 1, however, subjects were given handouts which were briefly discussed at the end of each lesson and given to take home after each session. The emphasis was also on teaching the content and cognitive domains.
3. ***ETU 3: Sport Studies (Netball-N3/Athletics-A3)***: this class was organised in a classroom and the lesson included discussions, use of charts and diagrams, viewing and evaluating short video clips, the use of the same handout given in ETU 3 and written work in the form of classwork. The emphasis again was on teaching the content and cognitive domains.

It must be noted that it was not the aim of this experimental design to make a treatment/non treatment comparison, thus a control group was not an essential ingredient in the experimental model (Verma and Mallick, 1999).

The development of the content and cognitive domains of the ETUs involved the specification of the teaching and assessment objectives and the course content. Teaching objectives have been defined as

“Statements that describe the abilities students should be able to display to demonstrate that important concepts and principles have been incorporated into their own structures of knowledge” Ebel and Frisbie (1991) pg. 48

This definition is a useful guideline in writing objectives, however, although the value and the role of instructional objectives is acknowledged by most educators there is little agreement

about how such statements should be prepared. Ebel and Frisbie (1991, pg. 50.) defined the anatomy of an instructional objective citing three components: “content portion, the underlying proposition and an operational part, the verb” Propositions are regarded as an essential ingredient in instructional objectives because these are an expression of the relevant content, but they are not one and the same. Ebel and Frisbie (1991) cited the following verbs to distinguish explicit and implicit statements of instructional objectives:

<b><i>Explicit, Behavioural, Observable</i></b>	<b><i>Implicit, Non-Behavioural, Inferential</i></b>
Identify, explain, describe, rearrange, summarise, select, develop, predict, differentiate, define, compare, write	know, consider, understand, enjoy, discuss, realise, remember, judge, perceive, think about, comprehend, imagine

Ebel and Frisbie (1991) pg. 50.

Ebel and Frisbie (1991) criticised the approach adopted by Grondlund and Linn (1990) for incorporating both implicit statements (general learning objectives) and explicit statements (specific learning outcomes) in instructional objectives. The purpose of the general learning objectives has been questioned for its usefulness whereas specific learning objectives including explicit learning outcomes described by verbs were regarded as the most useful for evaluation instrument development (Ebel and Frisbie, 1991). Linn and Grondlund’s (1991) (cited in Linn and Grondlund, 1995) approach to obtain a clear statement of instructional objectives was structured in two steps, firstly, a statement of the general objectives of instruction as intended leaning outcomes and secondly, a listing of a sample of the specific types of performance that students should be able to demonstrate when they have achieved the objective.

The cognitive domain (Bloom, 1956) of educational taxonomies was applied to the process of constructing the general and the specific teaching objectives of the ETUs. The major categories of Bloom’s (1956) cognitive domains are knowledge, comprehension, application, analysis, synthesis and evaluation. These categories were intended to be hierarchical in terms of the intellectual demands required of the learner (Ebel and Frisbie, 1991). Linn and Grondlund (1995) provided a very comprehensive list of general instructional objectives and clarifying verbs for Bloom’s cognitive domain. These are given in the table 3.5:

Table 3.5: Illustrative objectives and verbs defining Bloom’s cognitive domains

<b><i>Major cognitive domain</i></b>	<b><i>Illustrative General Instruction objectives</i></b>	<b><i>Illustrative verbs for stating specific learning outcomes</i></b>
Knowledge	Knows... Common terms, specific facts, methods and procedures, basic concepts, principles	Defines, <i>describes</i> , identifies, labels, lists, matches, names, outlines, reproduces, <i>selects</i> , states.

<i>Major cognitive domain</i>	<i>Illustrative General Instruction objectives</i>	<i>Illustrative verbs for stating specific learning outcomes</i>
Comprehension	Understands facts and principles Interprets...verbal materials, charts and graphs Translates verbal material to mathematical calculation Estimates consequences implied in data Justifies methods and procedures	Coverts, defends, <i>distinguishes</i> , estimates, explains, extends, generalises, gives examples, infers, paraphrases, predicts, rewrites, <i>summarises</i> .
Application	Applies...principles to new situations, theories to practical situations Solves mathematical problems Constructs charts and graphs Demonstrates correct usage of a procedure	Changes, computes, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses.
Analysis	Recognises..... unstated assumptions, logical fallacies in reasoning Distinguishes between facts and inferences Evaluates the relevancy of data Analyses the organisational structure of work (art, music, writing)	Breaks down, diagrams, differentiates, discriminates, <i>distinguishes</i> , identifies, illustrates, infers, outlines, points out, <i>relates</i> , <i>selects</i> , separates, subdivides.
Synthesis	Writes a well organised theme, a creative story (or poem) Gives a well organised speech Proposes a plan for an experiment Integrates learning from different areas into a plan for solving a problem Formulates a new scheme for classifying objects (or events or ideas)	Categorises, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organises, plan, rearranges, reconstructs, <i>relates</i> , reorganises, revises, rewrites, <i>summarises</i> , tells, writes.
Evaluation	Judges... The consistency of written material, the adequacy with which conclusions are supported by data, the value of work by the use of internal criteria and the use of external standards	Appraises, compares, concludes, contrasts, criticises, <i>describes</i> , discriminates, explains, interprets, justifies, relates, summarises, supports.

Adopted from Linn and Grondlund (1995) pg. 535

It is observed that some of the illustrative verbs appeared in more than one of the respective cognitive categories. These have been purposely formatted in italics and included: *describes*- knowledge and evaluation; *distinguishes*- comprehension and analysis; *relates*- analysis and synthesis, *selects*- knowledge and analysis; and *summarises*- comprehension and synthesis.

The process of constructing the ETUs involved fusing the terminology of instructional objectives with subject content (Netball and Athletics). The objectives developed for the ETUs included specifications of both content and cognitive. The content was compiled following a review of the netball and athletics content of GCSE and 'A' level PE syllabuses and practical assessment

handbooks (AEB 1996a, MEG 1997a, NEAB 1997, SEG 1997a, ULEAC 1997a, WJEC 1996). A selection of the content (techniques, tactics and rules) was adopted for the ETUs. A copy of the teaching and assessment objectives and course content for Netball and Athletics are placed in appendices 3.7 (athletics) and 3.8 (netball).

To address threats to validity and reliability to the study (Cohen and Manion, 1994) and to reduce the bias of the researcher towards any activity or teaching condition, for each of the Athletics and Netball ETUs:

- ◆ Detailed written documentation specifying the teaching and assessment objectives and the course content for each activity had to be produced and validated by expert teachers.
- ◆ The same teaching and assessment objectives and course content was to be applied to each of the three experimental teaching conditions of the respective activities.
- ◆ The test items and the marking schemes used at pre-test and post-test also had to be validated by expert teachers.
- ◆ The researcher was not permitted to mark the pre-tests and post-test but had to train markers.

#### ***3.4.2 Validation of objectives and content of ETUs***

The validation of the ETUs' objectives, content and test items were completed by expert-teachers and coaches as recommended by Vickers (1990). The selection of expert teachers was done in two stages. The Education Officer of PE of secondary schools in Malta was requested to nominate PE teachers with a strong background of teaching, and / or coaching and participation in any of athletics, netball and gymnastics (floor-work). (The latter was removed from the study at a later stage for reasons of feasibility of implementation). All the nominated teachers received an information sheet through postal mail to their schools, through which they were invited to participate in the validation exercises. If they were interested they were requested to fill in and to return the information sheet. Teachers were also requested to nominate other teachers with coaching and or officiating experience in the sports disciplines under study (see appendix 3.9). Those teachers who replied, and the recommended teachers were involved in the second stage of the validation exercise, which required the rating of objectives, content items and test items on a five point Likert scale. There were eleven completed replies for athletics and six for netball. The criteria for the selection of expert-teachers for either activity required involvement in teaching and coaching (school team or outside school) for a period of a minimum of five years and having attended at least one officiating or coaching course. From the returns, nine expert-teacher were retained for athletics and six for netball.

Linn and Grondlund (1995, pg. 36) identified the following four-tier structure as a guide of criteria for selecting a final list of teaching and assessment objectives: completeness, appropriateness, soundness and feasibility. Completeness answered the question: Are all important teaching outcomes included? Appropriateness questioned the relation of the outcomes to educational goals; soundness was related to the expected harmony between the learning outcomes and principles of learning; and feasibility defined the realistic achievement of the outcomes given students' abilities, time available and facilities. These questions were included in the validation sheet as guidelines to applying the validation criteria. The validation of the teaching and assessment objectives involved two distinct but related procedures. Firstly, expert teachers were required to rate every objective on a five point Likert scale on two criteria: appropriateness and soundness. Secondly, the whole list of teaching and assessment objectives was rated for completeness and feasibility (see appendix 3.10 (athletics) and appendix 3.11 (netball)).

The criteria for validating the course content was adapted from Ebel and Frisbie (1991) who suggested that written documentation of assessable content domains should be questioned for the relevance and importance that knowledge had to the entire universe of the content to be measured. Thus, the course content of the two ETUs (Athletics and Netball) was rated by the same expert teachers for its relevance and importance with reference to the physical activity as a sport discipline. The following questions were to be applied to every item in the validation process:

1. **Relevance:** is the content relevant to the unit of instruction?
2. **Importance:** is the content an important component of the content?

These questions were included in the validation sheets as guidelines to applying the validation criteria. Objectives that scored on the agreement side of the scale ( $m=3.5-5$ ) for appropriateness and soundness were retained for the ETUs. Content items, which had a low agreement regarding relevance and importance, were to be removed from the ETUs.

The objectives of the athletics ETUs all met the set criteria ( $m=3.5-5$ ) for appropriateness and soundness with the exception of one objective (IV-C: Evaluates selected performances: Judges given situations and communicates umpire's action), which acquired a mean score of 3.2. This came as a surprise since the objectives related to the application of rules to selected competitive events (II-A: Uses rules to given situations, and II-B: Demonstrates correct officiating procedures) both were approved as appropriate and sound objectives. From this rating it was somewhat indicated that putting the student in the role of an umpire as opposed to that of an athlete was not an unanimously agreed objective. This objective was thus removed from the athletics ETUs and judging/ roles of officials was not included in the scheme of work (SOW). The objectives of the netball ETUs all acquired a rating above  $m=3.5$  and were thus retained for

the study. It must be observed that the teacher experts validating the objectives were aware of the reduced time factor of the ETUs, and that the rating of objectives and content items was with reference to the conditions of the ETUs and the sport discipline.

The course content sub-sections for athletics (rules of events; techniques: sprints (100m, 200m, 400m), relays (4x100 and 4x400) and the shot put; and tactics) and the respective content items all gained convincing scores on the agreement side of the Likert scale above the set criteria of  $m=3.5$ .

The objectives for the netball ETUs all met the set criteria ( $m=3.5-5$ ) for appropriateness and soundness. The course content for the netball ETUs included rules; techniques; tactics: attack; tactics: defence; and positional play: Centre and Wing Attack. One content item (Rule 1: Equipment: Dimensions of the court, centre circle and goal circle) did not meet the set criteria as it scored 3.33 for relevance and 3.5 for importance on the Likert scales. This item was thus removed from the ETUs and was not incorporated in the SOW. All the other content items in these sub-sections obtained very satisfactory affirmative scores well above the set criteria on the Likert scales for both relevance and importance.

One must also note that the original time frame for each ETU was eight hours. However, when the different commencement dates of the school term, holidays and activities were taken into account, it was considered necessary to reduce the athletics ETUs to six hours and the netball ETUs to five hours for the experimental teaching and assessments to be completed by the end of term. Consequently, some of the objectives and content items were included in the course in less depth, however, precaution was taken for all content featured as assessment items to be covered in detail.

### ***3.4.3 Development of teaching documentation for ETUs***

The teaching documentation developed for the ETUs comprised schemes of work (SOW), lesson notes, handouts and classwork sheets. Given that the duration time of the lessons in different schools and ranged from 45 minutes to 1 hour 15 minutes, it became necessary to have documentation clearly outlining what each class was doing. Thus, the SOW and lesson notes were adjusted accordingly for each class (four classes for Netball and five classes for Athletics). Caution was taken to include exactly the same activities and teaching situations across the number of sessions, which varied from four to six lessons of teaching with each class.

Table 3.6: Number of classes and duration of sessions of ETUs

Teaching Condition	Classes and Schools		Duration of lessons	Nos of sessions	No of hours
A1	A1-Class 1	Sch-1	1 hour	6	6
	A1- Class 2	Sch-3	1.5 hours	4	6
A2	A2- Class 3	Sch-3	1.5 hours	4	6
	A2- Class 4	Sch-2	1 hour	6	6

Teaching Condition	Classes and Schools		Duration of lessons	Nos of sessions	No of hours
A3	A3- Class 5	Sch-2	45 min.-1 hour negotiated	6	6
N1	N1- Class 1	Sch-1	1 hour 15 minutes	4	5
	N1- Class 2	Sch-2	1 hour	5	5
N2	N2- Class 3	Sch-2	1 hour	5	5
N3	N3- Class 4	Sch-2	45 min. -1 hour negotiated	5	5

Detailed schemes of work (SOW) and lesson notes were developed for every teaching condition (three for each of netball and athletics). The content was adopted from the prescribed content of examined netball and athletics available in GCSE and Advanced Level syllabuses. It must be noted that not all the content in these exams syllabuses was used as the ETU is basically a brief series of sessions (Graham *et al.*, 1983). The ETU model also mandates a controlled setting in which the content to be taught is standardised, the learning environment is reduced in relation to time, space and number of students (Piéron and Cheffers, 1988).

The SOW were organised according to the three content categories; techniques, tactics and rules, which were to be covered in each session. An additional column for ETUs 2 and 3 included information on the handout(s), classwork sheets and video-clips used for each session. Copies of the schemes of work are included in appendix 3.12 (athletics) and appendix 3.13 (netball).

The ETUs presented a challenge of developing activities suitable for implementation in these different teaching environments, which essentially involved teaching the same content and cognitive domains and achieving the same instructional objectives. The main types of learning situations used for teaching content and cognitive domains in the three experimental teaching conditions are illustrated in table 3.7. ETUs 1 and 2 have been put together because the only difference between these two was the handout used at the end of session. For a copy of the handouts and the worksheets used in ETU 2 and ETU 3 see appendix 3.14 (athletics) and appendix 3.15 (netball). The learning outcomes described in the table are organised according to the joint content (techniques, tactics and rules and umpiring) and cognitive (knowledge and comprehension, application and analysis and synthesis and evaluation) domains (see column one).

Table 3.7: Learning outcomes of the ETUs

<i>Content and Cognitive domains</i>	<i>ETU 1- Physical Education and ETU 2- Physical Education Coursework</i>	<i>ETU 3- Sport Studies</i>
<i>Techniques: Knowledge &amp; Comprehension</i>	<ul style="list-style-type: none"> <li>◆ Performance <i>demonstration</i> by the teacher and students (or students) and verbal <i>description</i> and <i>explanation</i> of phases of techniques by the teacher</li> <li>◆ Handout including <i>description</i> of phases of techniques given to teaching condition 2</li> </ul>	<ul style="list-style-type: none"> <li>◆ Audio visual, diagrammatic and written/verbal <i>demonstration</i> and <i>description</i> and <i>explanation</i> of phases of techniques presented to the class by the teacher</li> <li>◆ Handout including <i>description</i> of phases of techniques given to class to consolidate audio-visual <i>demonstration</i></li> </ul>

<i>Content and Cognitive domains</i>	<i>ETU 1- Physical Education and ETU 2- Physical Education Coursework</i>	<i>ETU 3- Sport Studies</i>
		<ul style="list-style-type: none"> <li>◆ Classwork exercise <b>describing</b> phases of the technique</li> </ul>
<i>Techniques: Application &amp; Analysis</i>	<ul style="list-style-type: none"> <li>◆ Performance <b>demonstration</b> of the technique</li> <li>◆ Requested to observe a partner and analyse and <b>identify</b> specific phases of the technique</li> <li>◆ <b>Relate</b> performance of partner to the verbal <i>description</i> of technique and <b>point out</b> what is correct and what can be improved</li> </ul>	<ul style="list-style-type: none"> <li>◆ Requested to observe an audio-visual performance of a technique and to analyse and <b>identify</b> specific phases of the technique</li> <li>◆ <b>Relate</b> audio-visual performance to the <i>description</i> (written &amp; verbal) of the technique and <b>point out</b> what is correct and what can be improved</li> </ul>
<i>Techniques: Synthesis &amp; Evaluation.</i>	<ul style="list-style-type: none"> <li>◆ <b>Compare</b> the performance of a partner to the technical <i>description</i> of a technique and <b>explain</b> strengths and weaknesses</li> <li>◆ <b>Explain</b> how it can be improved and <i>describe</i> what needs to be <b>modified</b></li> <li>◆ Handout including <i>description</i> of faults of phases of techniques and how to correct them given to teaching condition 2</li> </ul>	<ul style="list-style-type: none"> <li>◆ <b>Compare</b> a visual performance <i>demonstration</i> to the technical <i>description</i> of a technique and <b>explain</b> strengths and weaknesses</li> <li>◆ <b>Explain</b> how it can be improved</li> <li>◆ <i>Describe</i> the faults of techniques and how to correct them and what needs to be <b>modified</b> in the practice</li> <li>◆ Handout including <i>description</i> of faults of phases of techniques and how to correct them.</li> <li>◆ Classwork exercise in conjunction with video clip to <b>discriminate</b> between strengths, faults and weaknesses of technique</li> </ul>
<i>Tactics: Knowledge &amp; Comprehension</i>	<ul style="list-style-type: none"> <li>◆ Performance <i>demonstration</i> and <b>examples given</b> by the teacher and students (or students) and verbal <b>description</b> of tactics by the teacher</li> <li>◆ Teacher simulates a situation of attack or defence and asks class to <b>give examples</b> of how to address challenge</li> <li>◆ Teacher asks class to practice and <b>define</b> the solution</li> <li>◆ Handout including <b>description</b> of phases of implementing the tactic given to teaching condition 2</li> </ul>	<ul style="list-style-type: none"> <li>◆ Audio visual, diagrammatic and written/verbal <i>demonstrations</i>, <b>examples</b> and verbal <b>description</b> of tactics <b>given</b> by the teacher</li> <li>◆ Teacher asks class in partners/groups to give a tactical <b>explanation</b> for a performance of an activity</li> <li>◆ Handout including <b>description</b> of phases of implementing the tactic</li> <li>◆ Classwork exercise <b>describing</b> phases of the tactic</li> </ul>
<i>Tactics: Application &amp; Analysis</i>	<ul style="list-style-type: none"> <li>◆ <b>Demonstration</b> of the tactic</li> <li>◆ Requested to observe a group practice and analyse the development of the tactic and <b>identify</b> its name</li> <li>◆ <b>Relate</b> group performance of the tactic to the verbal descriptions and solutions and <b>point out</b> the strengths and weaknesses</li> </ul>	<ul style="list-style-type: none"> <li>◆ Requested to observe a visual performance <b>demonstration</b> and to analyse the development of the tactic and <b>identify</b> its name</li> <li>◆ <b>Relate</b> the visual performance demonstration of the tactic to the previous visual /verbal descriptions and solutions and <b>point out</b> the strengths and weaknesses</li> </ul>

<i>Content and Cognitive domains</i>	<i>ETU 1- Physical Education and ETU 2- Physical Education Coursework</i>	<i>ETU 3- Sport Studies</i>
<i>Tactics:</i> Synthesis & Evaluation.	<ul style="list-style-type: none"> <li>◆ <i>Compare</i> live performances to the technical <i>descriptions</i> and <i>solutions</i> of the tactics and <i>explain</i> strengths and weaknesses</li> <li>◆ <i>Explain</i> how it can be improved and <i>describe</i> what needs to be <i>modified</i></li> <li>◆ Handout including <i>description</i> of strengths and weaknesses of the tactic given to teaching condition 2</li> </ul>	<ul style="list-style-type: none"> <li>◆ <i>Compare</i> the visual performance <i>demonstration</i> to the technical <i>descriptions</i> and <i>solutions</i> of the tactics and <i>explain</i> strengths and weaknesses</li> <li>◆ <i>Explain</i> how it can be improved and <i>describe</i> what needs to be <i>modified</i></li> <li>◆ Handout including <i>description</i> of strengths and weaknesses of the tactic</li> <li>◆ Classwork exercise on <i>planning</i> a tactic</li> </ul>
<i>Rules:</i> Knowledge & Comprehension	<ul style="list-style-type: none"> <li>◆ A rule is included in the performance situation and is <i>demonstrated</i> by the teacher and students (or students) while a <i>definition</i> and a verbal <i>description</i> is given by the teacher</li> <li>◆ During a group practice requested to observe and <i>identify</i> situations where the rule was infringed</li> <li>◆ Handout including <i>description</i> of the rule given to teaching condition 2</li> </ul>	<ul style="list-style-type: none"> <li>◆ Audio visual, diagrammatic, written/verbal <i>demonstration</i>, <i>definition</i> and verbal <i>descriptions</i> of rules presented by the teacher</li> <li>◆ Observe visual performance and <i>identify</i> situations where the rule was infringed</li> <li>◆ Handout including <i>description</i> of the rules</li> </ul>
<i>Rules:</i> Application & Analysis	<ul style="list-style-type: none"> <li>◆ <i>Relate</i> performance to the verbal <i>description</i> of the rule and <i>point out</i> the infringement.</li> <li>◆ <i>Demonstrate</i> and <i>identify</i> the correct umpiring action for an infringement</li> </ul>	<ul style="list-style-type: none"> <li>◆ <i>Relate</i> performance to the verbal <i>description</i> of the rule and <i>point out</i> the infringement.</li> <li>◆ Classwork exercise: <i>Identify</i> and <i>shows</i> the correct umpiring action for an infringement</li> </ul>
<i>Rules:</i> Synthesis & Evaluation.	<ul style="list-style-type: none"> <li>◆ <i>Compare</i> the group performance to the verbal description of rules and state how some rules can be <i>modified</i></li> <li>◆ <i>Explain</i> how the rule can be improved and <i>describe</i> what needs to be <i>modified</i></li> <li>◆ Handout including <i>description</i> of infringements of rules and the <i>interpretation</i> of the correct umpiring action.</li> </ul>	<ul style="list-style-type: none"> <li>◆ <i>Compare</i> the visual performance to the description of rules and state how some rules can be <i>modified</i></li> <li>◆ <i>Explain</i> how the rule can be improved and <i>describe</i> what needs to be <i>modified</i></li> <li>◆ Handout including <i>description</i> of infringements of rules and the correct umpiring action.</li> <li>◆ Classwork exercise: <i>Interpretation</i> of situations during the physical activity and umpiring actions</li> </ul>

Note that in the above table, the verbs (and their derivatives) presented in *italics bold* are the primary learning outcomes corresponding to Bloom's (1956) cognitive domains (see table 3.5). The other verbs in *italics* are also part of the learning outcomes, however, these do not correspond to Bloom's cognitive domains. Some of the verbs have not been derived from Bloom's list of illustrative verbs.

The development of lesson notes, handouts and classwork sheets for the respective physical activities and teaching conditions were the product of a variety of teaching resources which included tried out activities in books, resource packs, coaching manuals and video clips. The use of visuals, namely, performance demonstrations in the practical teaching set-up, and videos clips

and diagrams/illustrations on handouts and worksheets in the class-based teaching environment were aimed at providing a more meaningful learning experience. Visuals provide information and attract and hold learner's interest (Heinich *et al.*, 1996). The planned lesson development supported the strategy of the GFU and KS approaches where both the content and cognitive domains were included in each activity.

The classwork tasks, exercises, and questions used for the ETUs of athletics and netball for ETU 2 (Physical Education Coursework) and ETU 3 (Sport Studies) were taken from past papers of GCSE and 'A' level PE, and multiple choice questions (Walker, 1987). The source from where these were taken was acknowledged on the handouts and classwork sheets. The teaching resources used for netball and athletics are described in the following sections.

#### *3.4.3.1 Teaching resources used for Netball*

The netball resources comprised books, videos and past-papers. Galsworthy (1996) included detailed descriptions; diagrams and photos of the basic skills needed for netball for early practices and advanced practices. This book also included a section on physical qualities and roles of players, planning a coaching session, physical preparation and fitness training for competitive netball. Another book by Galsworthy (1993) included history and development of the game, a section on terminology used in netball, application of rules to particular situations in a game and descriptions and diagrams of techniques. This book was an introductory text to GCSE netball. It must be noted that Galsworthy (1993; 1996) does not include male demonstrators in her books. The book by Lloyd and Jeffries (1993) was also an introductory book, which covered, techniques, tactics, basic rules and terminology of the netball game. It included very attractive diagrams and photos with male and female players demonstrating action. Another useful book by Crouch (1992) comprised detailed descriptions with photos and matchstick diagrams of netball skills and tactics and also included a series of graded group practices combining skills and tactics. There were also sections on planning a coaching programme and the roles and physical qualities of players. This book also included references to physiological, psychological and biomechanical applications to netball. The coaching guide by Rattu and Smith (1995) included practices for coaching netball with most drills failing to combine technique with tactics, however, a lot of the practices were acknowledged to be enjoyable and covered passing, footwork, attacking, defending, shooting skills and modified games. Another interesting book for teaching GCSE and 'A' level netball (Shakespeare, 1997) included diagrams of skills and tactics demonstrated by female and male players as well as keypoints for success which were recommended guidelines for correction of faults and errors of skills and tactics.

The Netball Know the Game (KTG) book (AENA, 1994) included very good diagrams explaining the application of selected netball rules in combination with application of techniques (passing, attacking, defending and shooting) in a game situation. The All England Netball Association (AENA) student information pack (AENA, 1996) included a detailed history of the netball game covering the period 1891-1995, a background of the aims and mission of the International Federation of Netball Associations (IFNA), specifications of sponsors and advertising during competitions, disability development plan, and a detailed programme of international, national events and coaching opportunities. Another useful book by the Diagram Group (1990) covered the rules of numerous activities, including netball. This book gave working descriptions of the basic rules of sports activities and included diagrammatic details to illustrate selected rules. The rules of the netball game were published in booklets (AENA, 1991; AENA, 1997) and had been revised every 7 years. The rules will be revised every four years in prospective years. The rule booklets included statements of rules, however, the analysis of a situation and the application of the rules is something that needs to be addressed in the teaching situation, or by referring to hypothetical situations, such as “rules clinic” Galsworthy, (1996). For technical reasons the latest revision of the rules was effected in the playing season starting September 1998 and the rules of 1991 were used for the rules content of the ETUs for this study.

The diagrams, descriptions and practices in these books were screened for selecting the most relevant and appropriate diagrams and notes for handouts. Caution was taken to acknowledge all sources from where materials were taken.

The following All England Netball Association (AENA) videos, were also used to demonstrate or discuss skills, tactics and rules of the netball game for the lessons of ETU 3: Sport Studies Netball.

1. “Introducing Netball”, 30 minutes: (Excerpts From Umpiring Series No 1 And Coaching Series No 2).
2. “Basic Skills”, 30 minutes; (Coaching Series No 1).
3. “Skills in advanced play”, 33 minutes; (Coaching Series No 2).
4. “Netball for the under twelve’s”, 30 minutes; (Coaching Series No 3)
5. “Basic umpiring”, 30 minutes; (Umpiring Series No 1).
6. “Advanced umpiring”, 40 minutes; (Umpiring Series No 2).

These videos were seen twice for the purpose of logging the time, the content and specifying the aspect covered (technique, tactic, rule and umpiring) on these videos. This facilitated accessing the relevant video clips for the purpose of analysis of performance as recommended by some examining boards (SEG, 1998b pg. 21).

The exercise of going through books and videos was quite complex and time consuming and exposed the fact that one single teaching pack addressing the content and cognitive requirements for teaching GCSE and 'A' level netball was not readily available. The teacher needed to consult and utilise a variety of resources. The books included extensive coverage of techniques but limited coverage of tactics, strategies and rules of the game. The books also lacked activities stimulating observation and analysis of techniques and tactics or any written activities.

The tasks and questions of the written classwork sheets were compiled following a review of questions and their answers from past-papers and marking schemes on netball. Examining boards with questions specifically on netball included the WJEC, the MEG, the LEAG/ULEAC and the SEG. The questions from these past-papers were classified as per content and cognitive domains and were entered in a database to facilitate quick referencing and access.

The netball sessions were conducted on netball courts/volleyball courts with goal posts. Other equipment used included net balls, two sets of netball bibs and flat cones. These were either available in schools and if not, the researcher borrowed them from the sixth-form college of the university. An additional set of netball bibs was borrowed from the Maltese Netball Association.

#### *3.4.3.2 Teaching resources used for Athletics:*

The teaching resources used for developing the ETUs of athletics included books, videos and past-papers. For athletics, Roscoe (1996) published a pack including videos geared specifically for teaching athletics at Advanced Level (AEB). The pack covered all the coursework, namely, performance, training programmes and analysis. For every event, this pack included a detailed description and diagrammatic presentation of the various phases of each technique together with the faults, causes of faults and corrections. These were presented in the form of photocopyable handouts that could be used with parts of the three videos that accompanied the resource pack. The three videos were: track events (2 hours 20 minutes), jumps event (2 hours 15 minutes) and throw events (2 hours 20 minutes). This pack also includes information on the British Athletics Federation and a brief description of athletics history. This pack did not include relays, and rules were very brief and not consistently mentioned across all events, however, information about where to obtain an athletics rules book was provided.

Apart from the Roscoe (1996) videos, the "Running events" (1990) video also provided extensive use of slow motion and stop-action photography showing the correct techniques required for running events and the common faults and the drills to correct those common faults. This video provided detailed techniques of starts from blocks and relays and was of 35 minutes duration.

These videos were also seen twice and were time logged for both content and cognitive specification of video clip details. These videos were used to demonstrate or discuss skills, tactics and rules of the athletics for the lessons of ETU 3: Sport Studies Athletics.

A useful athletics book for practical activities, diagrams and descriptions of events (Carr, 1991) included techniques and common errors and their corrections and covered relays too. It also contained teaching steps for each technique and suggested standards of performance for the 11-19 years age groups. International Amateur Athletics Federation (IAAF) coaching manuals (IAAF, 1990; Thompson, 1991) were also used. These comprised diagrams, sequenced photos and brief descriptions of techniques and teaching progressions. *The Know the Game: Track athletics* (BAF, 1994) and *track and field athletics* (Johnson, 1984) included descriptions, diagrams and photos of various techniques and the relevant disqualification rules. There was also a brief description of training programmes. Basic rules of the athletic events selected for the ETUs were taken from a book by the Diagram Group (1990). The couple of pages allocated to each sports activity in this book provide descriptions of selected basic rules of different events, which are also illustrated in diagrammatic representations. The complete rules of athletics were taken from Pocock (1995, pg. 81-144) while the revised rules of athletics were made available through the Maltese Amateur Athletic Federation.

The tasks and written activities of classwork sheets for ETU 3 were compiled following a analysis of questions from past-papers and answers from marking schemes on athletics. The examining boards that offered specific questions on athletics were the MEG, the LEAG/ULEAC and the SEG. A multiple choice question bank on athletic activities (Walker, 1987) was also included with the task items. These items were classified as per content and cognitive domain and were entered in a database.

The development and organisation of the athletics lesson notes and the use of the relevant teaching resources was less complicated than it was for netball since teaching resources for 'A' level athletics were available (Roscoe, 1996). However, more knowledge and detail of rules, physical qualities of athletes and planning involved in the events needed to be developed by the teacher.

The equipment used for the athletics sessions included small apparatus such as small foam balls, quoits, batons, medicine balls, shot put, Olympic starting blocks, measuring tape, finish line string and cones. Some of these were available in schools, others were borrowed by the researcher from the sixth-form college of the university. Three Olympic starting blocks were borrowed from an

athletics club. The Olympic blocks were made available to the volunteer teacher offering physical education athletics for all the sessions.

#### ***3.4.4 Filming the ETUs***

The ETUs were filmed by final year (3<sup>rd</sup> year) undergraduate students on a B.A. communications course as part as their video productions placement. The researcher and the video productions placement tutor met and discussed the objectives of the placement and the requirements of the filming to facilitate the application of a systematic observation instrument (CAFIAS) for the purpose of analysing the ETUs. The following requirements were identified and communicated to the video-graphers by the researcher and the video productions tutor:

1. Each session was to be filmed by two video-graphers, one filming the teacher continuously and the other the students. The video-graphers/ cameras were not to interfere with the development of the sessions and were requested to position themselves just outside the perimeter from where the activity was taking place, in particular in the practical settings.
2. Since most of the filming was going to be outside, video-graphers were to have ample battery supply for both video-cameras for each lesson.
3. The filming had to start exactly on the time the lesson was supposed to start, even if all students had not turned up yet.
4. Video-graphers were given an information sheet to familiarise them with the locations and the contact PE teachers in every school and the week days, times and number of filming sessions for each of the nine classes. The coupling of students and the filming schedule was organised by the placement tutor.
5. Video cameras were made available to the video-graphers by their department, however, the researcher had to provide the videos for the recordings of the sessions.
6. The video-graphers were not to edit any of the videotapes, but to give the recordings intact to the researcher, noting the date and class details on each video. They were also requested to label the videocassettes with details of the filmed teacher, the physical activity and the experimental teaching condition for each session.
7. In the case of inclement weather, sessions were held indoors and filming still took place.
8. Video-graphers filming on the other island travelled with the researcher and had their ferry expenses paid by the researcher.

The video-graphers were also made aware of the importance of filming everything that went on in the lesson. Some wanted guidance about where to locate themselves and they were advised to use their own judgement and find a safe distance away from where movement and equipment could have been a threat to their safety and their equipment.

It was decided to have two video recordings for each session, first and foremost to facilitate the clarity and identification of the teacher's and students' verbal and non verbal exchanges, and secondly to have a back up recording just in case something went wrong with one of the cameras. It was also decided to film all the classes, even though the same lesson was being repeated with another class as was the case with Physical Education Athletics; Physical Education Coursework Athletics and Physical Education Netball. This was done to have recordings on which to practice training to use the systematic observation system that was to be used for analysing the ETUs and to have back up recordings, just in case for some reason the recording of a session was not possible or some technical fault developed in the equipment. Eventually some technical faults did take place and the back-up recordings were made use of.

#### ***3.4.5 Analysis of experimental teaching units (ETUs)***

The major aim of the analysis of the ETUs was to identify the differences and similarities that the experimental teaching conditions exerted on the physical activities, the content, the engagement time and the behaviours of the teacher and the pupils. This study was not an attempt to tell teachers who are preparing students for GCSE and 'A' level PE courses how to teach, but to alert them to some of the subtle and complex processes of interaction that directly shape and influence learning. What research here can do is to describe the circumstances, background and parties (teacher, students, gym-attendants) involved in the interactions that routinely take place in the classroom (Hitchcock and Hughes, 1995). Observing classroom interaction systematically is one approach to produce objective accounts of what happens in the classrooms. These systematic observation techniques involve a trained observer recording certain features of teacher and/or pupil behaviours in accordance with a pre-arranged schedule so that numerical counts could be quantified in terms of a set of pre-coded categories. It is argued that the use of trained observers and an "uncontaminated" coding scheme ensures a measure of objectivity and neutrality reducing the possibility of any researcher effect or bias. The possibility of covering a large number of situations enables interaction analysis and systematic observation to develop generalisations, which makes suggestions about effective teaching possible. Systematic observation techniques have been a source of major criticisms, and as Hamilton and Delamont (1974) argued, although the approach may offer some insight into the general patterns of communications, they fail on describing relationships and interpersonal communication. Rosenshine and Furst (1972) also voiced uncertainty over whether systematic observation will ever be able to extract those variables that discriminated more effective from less effective teachers.

Systematic observation techniques were also developed specifically for analysing and describing physical education teaching (Darst *et al.*, 1989) and this type of research answers to

the question of what typically goes on in the PE lesson. This was in congruence with the aim of the research, since, systematic observation and interaction analysis measure teacher and student behaviours and interactions. Thus, systematic observation techniques were regarded as useful for describing and analysing the ETUs. The selection of a system suitable for analysis of the ETUs for this study required other practical criteria to be met, namely, that it could be applied to practical based and class-based PE sessions.

### ***3.4.6 Systematic observation methods***

Darst *et al.* (1989), reviewed thirty-one systems of systematic observation applicable to PE and sport scenarios, providing details such as the aim, the behaviours observed, the categories of each system and their description, the recording procedure and the complexity of each system. Six of these systems met the aim of the analysis of the ETUs but some failed on the practical elements of the study. The systems were

1. FIAS: Flanders Interaction Analysis System (Flanders, 1965)
2. CAFIAS: Cheffers Adaptation of Flanders Interaction Analysis System (Cheffers, 1972)
3. PATTERN ANALYSIS (Zakrajsek, 1977)
4. OSCD-PE: Observation Instrument for Content Development in Physical Education (Rink, 1979)
5. QMTPS: Qualitative Measures of Teaching Performance Scale (Rink and Werner, 1989)
6. WVUTESFT: West Virginia University Teaching Evaluation System and Feedback Taxonomy (Hawkins and Wiegand, 1989)

The details of each system, namely, the purpose, major categories and category systems are found in table 3. 8.

Table 3.8: Overview of Selected Systematic Observation Instruments

DETAILS	FIAS	CAFIAS	PATTERN ANALYSIS	OSCD-PE	QMTPS	WVUTESFT
Date	1965	1972	1977	1979	1989	1989
Purpose	Analyses verbal interaction between teacher and students	Analyses Verbal and Non-verbal Interaction Between Teacher and Student	Describes how instructional time is allotted in the classroom	Describes the process of content development in physical education classes	Observes relationship among task presentation, student responses and teacher feedback with quality of student responses	Describes a comprehensive set of teacher and student behaviours student behaviours parallel to ALT-PE
Categories						
Verbal Behaviours	Teacher Student	Teacher Student	Teacher	Teacher Student	Teacher	Teacher
Non Verbal Behaviours	-	Teacher Student	Student	Teacher Student	Student	Teacher Student
Recording Technique	Interval (3 seconds)	Event Interval (3 seconds)	Interval (5 seconds)	Interval (5 seconds)	Event	Event and Interval
Major Categories	<ul style="list-style-type: none"> <li>• <i>Teacher Talk</i></li> <li>• <i>Student Talk</i></li> <li>• <i>Silence / Confusion</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Teacher Behaviour</i></li> <li>• <i>Student Behaviour</i></li> <li>• <i>Silence / Confusion</i></li> </ul>	<i>None</i>	<ul style="list-style-type: none"> <li>• <i>Communication Function</i></li> <li>• <i>Content Function</i></li> <li>• <i>Source/ Recipient Behaviour</i></li> <li>• <i>Other Categories</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Type of Task</i></li> <li>• <i>Task Presentation</i></li> <li>• <i>Student Response Appropriate To Task</i></li> <li>• <i>Focus</i></li> <li>• <i>Teacher Specific Congruent Feedback</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Teacher Behaviour</i></li> <li>• <i>Student Behaviour</i></li> </ul>

DETAILS	FIAS	CAFIAS	PATTERN ANALYSIS	OSCD-PE	QMTPS	WVUTESFT
System Categories	<p><b>Teacher Talk-Indirect Influence</b>  Accepts Feelings  Praises or Encourages  Accepts or Uses Ideas of Students  Asks Questions  <b>Teacher Talk –Direct Influence</b>  Lectures  Gives Direction  Criticises or Justifies Authority  <b>Student Talk</b>  Responds  Initiates  <b>Silence or Confusion</b>  Silence or Confusion</p>	<p><b>Teacher Behaviours</b>  Praises or Encourages  Accepts or Uses Ideas of Students  Asks Questions  Gives Information  Gives Directions  Criticises or Justifies Authority  <b>Student Behaviours</b>  Student Predictable Response  Student Interpretative Behaviour  Student Initiative Behaviour  <b>Silence or Confusion</b></p>	<p>Preparatory  Organisational  Content Presentation  Developmental  Recreational  Controlling  Summation  Departure  Non-directed  Evaluation</p>	<p><b>Communication Function</b>  Soliciting  Responding  Initiating  Appraising  <b>Content Function</b>  Informing  Refining  Extending  Applying  Conduct  Organisation  <b>Source/ recipient of Behaviour</b>  Class  Individual  Small Group  Individual / Public  <b>Other Categories</b>  Indirect/Overt  Indirect /Covert  Non- functioning  Movement Task</p>	<p><b>Type of Task</b>  Informing  Refining  Extending  Repeat  Applying  <b>Task Presentation</b>  Clarity  Demonstrate  Appropriate Number of Cues  Accuracy of Cues  Qualitative Cues  Provided  <b>Student Responses Appropriate To Task</b>  <b>Teacher Specific Congruent Feed Back</b></p>	<p><b>Teacher Behaviour</b>  General Observation  Encouragement  Positive Feedback  Corrective Feedback  Management  Instruction  Modelling  Physical Guidance  Non-task Verbal  Off-Task  Specific Observation  <b>Student Behaviour</b>  Motor Engaged  Motor Appropriate  Motor Inappropriate  Motor Supporting  Cognitive  On-Task  Off Task  Interim  Waiting</p>
Number of categories	10	20	10	12	20	20

Adopted from Darst *et al.* (1989)

It must be noted that ALT-PE was not short listed for consideration for suitability of analysis of this study because this system focused entirely on the student motor engagement in the lesson, which was of no direct relevance to the study. This system had two categories: contextual level and learner involvement (Parker, 1986) which were most appropriate for practical settings. The purpose of this instrument was to measure the portion of time in a PE session that a pre-selected student was involved in motor activity at an appropriate success rate providing a picture of “shadow of shadows... a meager representation of the richness of realities” Anderson (1983, pg. 54). This system did not comprise the inclusion of teacher behaviours or teaching in an environment other than the practical setting, making this instrument of very limited use for this study.

The purposes and the categories of the systems exhibit the variety and richness of details available for evaluating the PE lesson in the practical setting, however, the class-based PE lesson has not been included in the majority of the systems with the exception of CAFIAS. The researcher made direct contact with the author, John Cheffers at Boston University, who supplied a detailed manual and a computer programme for analysing the data using CAFIAS.

### **3.4.7 CAFIAS categories and parameters**

The CAFIAS manual (Cheffers *et al.*, 1980) provided details of training requirements to use the system, categories, episodes and their interpretation, data entry, generation of percentages and ratios and the major parameters of CAFIAS.

CAFIAS categories included verbal and non-verbal behaviours. The twenty CAFIAS categories included twelve teacher behaviours (2 – 17), six (8 - 19) student behaviours and two other categories; silence and confusion (10 - 20). The CAFIAS verbal and non-verbal behaviours are provided in the table 3.9 and a description of each category is found in appendix 3.16.

Table 3.9: CAFIAS categories

<b>Categories</b>	<b>Verbal</b>	<b>Non-verbal</b>
<b><i>Teacher Behaviours</i></b>		
Praises or Encourages	2	12
Accepts or Uses Ideas of Students	3	13
Asks Questions	4	14
Gives Information	5	15
Gives Directions	6	16
Criticises or Justifies Authority	7	17
<b><i>Student Behaviours</i></b>		
Student Predictable Response	8	18
Student Interpretative Behaviour	8\	18\

Categories	Verbal	Non-verbal
Student Initiative Behaviour	9	19
Confusion or Silence	10	20

CAFIAS allowed for the generation of the most frequent behaviours and interaction patterns using a 20x20 matrix enabling the division of verbal and non-verbal behaviours (Cheffers *et al.*, 1980, pg. 58) and the 60x60 matrix providing further information on the teaching agent, namely, the teacher (./t), student (s) and the environment (e). The 60x60 matrix was regarded as more informative and was used to analyse the data. The top ten cells from the 60x60 matrix were identifiable after inspection of the highest raw frequencies of pair behaviours representing the interactions (e.g. 5t-5t). The percentage time spent on the interaction was calculable by dividing the total number of tallies of each ETU with the number of frequencies of interactions. For the purpose of analysis the top ten cells and the percentage time of the interactions will be discussed with reference to each of the six ETUs.

The computer programme provided by Cheffers did not function due to incompatibility of operating systems. Thus, a programme generating the same 60x60 matrix, frequencies of each behaviour, the percentage time of each behaviour and the teaching environment (teacher, student, environment) and the top ten cells of each lesson was developed (Datalyser). This programme also included the option to collapse the data of a number of lessons together, which was most useful for this study as it provided the opportunity of having data of each lesson and of an entire ETU.

There were forty-one parameters of CAFIAS (Cheffers *et al.*, 1980, pg. 40-47) and of these, thirty one were designated as “Major Parameters of CAFIAS” (Cheffers *et al.*, 1980, pg. 75). These parameters provided the possibility of generating ratios and percentages of the verbal and non-verbal interactions and calculations of the time on content and the teacher agency variety. The major parameters of CAFIAS were to be used for the analysis of data, however, three of these parameters were not of direct reference to the study and were omitted for the purpose of analysis. These comprised parameters aimed at quantifying the class structure (one unit, groups or individuals, no teacher influence; Parameters Number 38-40: Cheffers *et al.*, 1980, pg. 40-47). However, another three parameters calculating the student verbal input and dependency (Numbers 22-24: Cheffers *et al.*, 1980, pg. 40-47) were included in addition to the major parameters as the student verbal input was of relevance to the inquiry of the study. Note that the numbers listed in the first column of table 3.10 are the ones of the parameter and the corresponding formulae as described in the manual (Cheffers *et al.*, 1980, pg. 40-47). A

list of all the parameters and the formulae are available in appendix 3.17. The parameters that will be used to analyse the ETUs are listed in the table 3.10:

Table 3.10: CAFIAS parameters.

No	Statistic	Major Parameters of CAFIAS	Abbreviation
1.	%	Teacher Contribution, Verbal	TCV
2.	%	Teacher Contribution, Non-verbal	TCNV
3.	%	Total Teacher Contribution	TTC
4.	%	Student Contribution, Verbal	SCV
5.	%	Student Contribution, Non-verbal	SCNV
6.	%	Total Student Contribution	TSC
7.	%	Silence	S
8.	%	Confusion	C
9.	%	Total Silence and/or Confusion	TSC
10.	Ratio	Teacher Use of Questioning, Verbal	TQRV
11.	Ratio	Teacher Use of Questioning, Non-verbal	TQRNV
12.	Ratio	Total Teacher Use of Questioning	TTQR
13.	Ratio	Teacher Use of Acceptance and Praise, Verbal	TAPRV
14.	Ratio	Teacher Use of Acceptance and Praise, Non-verbal	TAPRNV
15.	Ratio	Total Teacher Use of Acceptance and Praise	TTAPR
22.	%	Total Student Verbal Input	TSVDR
23.	%	Total Student Non-verbal Dependent	TSNVDR
24.	%	Total Student Dependant	TSDR
25.	Ratio	Student Verbal Initiation, Teacher Suggested	SVITSR
26.	Ratio	Student Non Verbal Initiation, Teacher Suggested	SNVITSR
27.	Ratio	Total Student Initiation, Teacher Suggested	TSITSR
28.	Ratio	Student Verbal Initiation, Student Suggested	SVISSR
29.	Ratio	Student Non verbal Initiation, Student Suggested	SNVISSR
30.	Ratio	Total Student Initiation, Student Suggested	TSISSR
31.	Ratio	Content Emphasis –Teacher Input	CETI
32.	Ratio	Content Emphasis- Student Input	CESI
33.	%	Teacher As Teacher	TT
34.	%	Other Students As Teachers	ST
35.	%	The Environment As Teacher	ET
36.	%	Verbal Emphasis	VE
37.	%	Non verbal Emphasis	NVE

These parameters allowed for a detailed description of the teacher and student behaviours and a comparative analysis of the three experimental teaching conditions for each of the two physical activities. A comparison of the experimental teaching conditions across the physical

activities can also indicate patterns of athletic type activities: athletics, might differ from game type activities: netball.

### ***3.4.8 Training of Observers***

The coding of the ETUs required more than one observer for the purpose of getting a measure of reliability (Cheffers *et al.*, 1980), thus the ETUs were observed and recorded by the author and two B.Ed. students, one for netball and one for athletics. The training for the use of CAFIAS involved a thorough understanding of the categories and the behaviours of each category. The main aim of the training programme was to facilitate and enable the automatic transfer from words or visual performances to the numbers representing a behaviour (categories) over an interval of three seconds. For example a teacher's question was coded as a "4". Guidelines for a training programme were provided in the manual (Cheffers *et al.*, 1980 pg. 13-14), which included the following steps:

- A small group of observers begin by categorising together from tape-recording of classroom sessions (episodes)
- The observers categorise separately and compare results and discuss disagreements upon completion. Tapes of several classroom interactions, different subject areas at various grade levels were recommended for this stage.
- The clarifications of categories arising from comparisons and disagreements were to be noted and ground rules were to be established as necessary to assist in consistent interpretation of behaviour and reliability.
- Six to ten hours of training with tapes was suggested to get observers ready to apply CAFIAS efficiently.

The training programme consisted of seven sessions totalling nine hours of instruction. The first phase was to make the observers familiar with the categories and the corresponding behaviours. The next phase was aimed at consolidating the automatic equating of behaviours with CAFIAS number categories and improving the timing of the interval recordings. The recording of the teaching agents and the class organisation came next and these were followed by observing and recording extracts from all the teaching conditions of the main study. Details of the categories, subject areas, grade levels, interval targets and duration of each session are presented the table 3.11. A description of the training programme and the activities of each session are included in the appendix 3.18.

Table 3.11: Structure of training sessions for using CAFIAS

Session Date	CAFIAS behaviour categories Observation and Discussion	Subject area	Grade	Interval target	Duration of session
1 Monday 19.1.98	Interpretation of behaviours using all CAFIAS categories [episodes from the manual]	Episodes: interpretation of teacher and student behaviours in class-based classes	various	Observe and record at intervals of 10 seconds. Discuss every record	75 minutes
2 Wednesday 21.1.98	Observe a filmed lesson and use all CAFIAS categories for interpretation	G Graham <sup>1</sup> Early primary class “throwing” - circuit groupwork Female teacher	age 5-6	Observe 10 consecutive behaviours at intervals of 10 seconds and discuss. Observe and record at intervals of 5 seconds	75 minutes
3 Thursday 22.1.98	Observe a filmed lesson using CAFIAS categories for interpretation	G. Graham <sup>1</sup> Primary school class “matching”- partner work Female teacher	age 7-9	Observe 6 consecutive behaviours at intervals of 5 seconds. Discuss	75 minutes
4 Monday 26.1.98	Observe a filmed lesson using CAFIAS categories for interpretation  Observe and record verbal and non-verbal behaviours occurring simultaneously as O e.g.(5)	G Graham <sup>2</sup> Hockey and rope activities Individual work and groupwork Male teacher	age 12-14	Observe 10 consecutive behaviours at intervals of 5 seconds Observe behaviours at intervals of 5 seconds for 8 consecutive minutes	75 minutes
5 Tuesday 27.1.98	Observe a filmed lesson using CAFIAS categories for interpretation  Observe teaching environment and record [teacher (/t); environment (e); student (s)]	G Graham <sup>2</sup> Co-educational Football Female teacher Netball practical class Researcher	age 10-12    age 16-17	Observe behaviours at intervals of 5 seconds. Observe 3 consecutive behaviours at intervals of 3 seconds	75 minutes

Session Date	CAFIAS behaviour categories Observation and Discussion	Subject area	Grade	Interval target	Duration of session
6 Wednesday 28.1.98	Observe a filmed lesson using CAFIAS categories for interpretation  Observe class organisation [part (P); whole (W) ; no teacher influence (I)]	Athletics theory class Researcher	age 16-17	Counted silently 1 and 1, 2 and 2 and 3 and 3, then observed and recorded at intervals of 3 seconds for 10 minutes. Discuss agreements and disagreements.	75 minutes
7 Thursday 29.1.98	Observe of a filmed lesson using CAFIAS categories  consolidation of teaching environment and class organisation	Netball Practical only Athletics Class based session Athletics Practical and handout Researcher	age 16-17	Observe 40 consecutive behaviours at intervals of 3 seconds Observe 60 consecutive behaviours at intervals of 3 seconds Listened to pre-recorded bell signal every 3 seconds.	90 minutes
					9 hours

- 1 George Graham: "Teaching Physical Education - Becoming a Master Teacher Video" (1994) Human Kinetics
- 2 George Graham: "AMTP Pedagogy course Self-Study Video" (1993) Human Kinetics

### 3.4.9 Inter observer reliability

When the recording of all the sessions were finished, the third session from each ETU was selected for a measure of inter-observer reliability. The first 400 tallies of each of the three sessions for netball and athletics were compared one to one and the following reliability formula was used: (Siedentop, 1991)

$$\text{Reliability (\%)} = \frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}} \times 100$$

The reliability (%) calculations for each of the teaching condition were as follow:

Experimental teaching condition	Netball	Athletics
1	89%	93%
2	89%	93%
3	93%	96%
Aggregate	90%	94%

These percentages indicate a very acceptable level of reliability since they are higher than 88% (Siedentop, 1991)

### 3.5 The modes of assessments of ETUs

The development of the modes of assessments was the next phase in this study. The process of constructing the assessment instruments involved a series of steps, namely; formulation of a table of specifications, the selection and justification of the modes of assessment suitable for the ETUs, and the selection and validation of the test items. There were two assessment modes for each physical activity, an unseen written paper (W.P.) and a video based unseen written paper (V.P.). Expert teachers validated the questions and the answers of the assessment instruments while lecturers validated the classifications of each test item for the content and cognitive description.

Linn and Grondlund (1995) stated that the content considerations are of special importance when we wish to describe how an individual performs on a domain of tasks that the assessment is supposed to represent. The teaching and assessment objectives described the types of performance students were expected to demonstrate and the content indicated the areas in which the expected performance was to be shown. The *Table of Specifications* is a procedure used to bring the course content and the teaching and assessment objectives together. The development of the table of specifications was used to indicate the relative emphasis to be given to each objective and each content area, and to identify the percentage marks which were to be allocated to the content and cognitive domains. This table was also a first step to provide “balance in a test” (Ebel and Frisbie, 1991, pg. 120). The content domain of techniques was awarded 40% of the marks while tactics and rules were each allocated 30% each. These percentages indicate that all content areas were of relatively equal importance but slightly more time was expected to be spent on techniques during teaching. The six hierarchic

cognitive domains (Bloom, 1956) were collapsed into three bi-partite streams. Knowledge and comprehension were allocated 30% of the total mark, application and analysis 40% and synthesis and evaluation 30%. Again, the three streams shared relatively equal importance, however, the amount of time spent on application and analysis was anticipated to be more than the time spent on the other two cognitive streams.

Table 3.12: Table of specifications

<b><i>CONTENT DOMAIN</i></b>	<b><i>COGNITIVE DOMAIN</i></b>			
	Knowledge and Comprehension	Application and Analysis	Synthesis and Evaluation	Total mark
Techniques	12	16	12	40
Tactics	9	12	9	30
Rules	9	12	9	30
Total mark	30	40	30	100

These percentages in the table of specifications also represented the percent of test points to be allocated irrespective of the number of items in each cell. The next phase of the study involved the selection of the modes of assessment and the construction of the test items. In this criterion referenced situation the goal was not to produce tests that are hard, moderate, or easy. The purpose, as Ebel and Frisbie (1991) suggest, was to translate the test specifications [domain definition] into relevant test items. The development of the test plan involved the description of the abilities of interest and the domain of knowledge and skills to be included, a decision on the relevant importance of the knowledge sub-domains and a determination of the types of items that best require the demonstration of relevant knowledge

### ***3.5.1 Construction of modes of assessment and test items***

The construction of the modes of assessments involved the selection of both the mode and the test items. This matter required consideration of the validity and the reliability of the existing modes of assessments aimed at examining cognitive components such as “analysis and evaluation of performance” of GCSE and ‘A’ Level PE as well as the test items in use. This study questioned the validity and reliability of unseen written papers, practical performance and oral tests for assessing the cognitive domains of knowledge recall, application, analysis and evaluation of skills, techniques and rules of physical activities. The unseen written papers (pre-1998) addressed an arbitrary selection of cognitive and content components, which made the tests unbalanced. This study also maintained that performance tests aimed at assessing the abilities to demonstrate and apply skills, techniques and rules to the game/competitive situation should be kept separate from tests aimed at assessing cognitive components. Meanwhile, the use of the practical performance tests have been criticised for the lack of opportunities that they provide for the candidates to demonstrate their knowledge and application of the content (techniques, tactics and rules) (Carroll, 1994) and examiners have also commented that

“the drills seen were not seen as sufficiently challenging and as a consequence candidates were rarely stretched or placed in situations which called for the tactical knowledge or techniques required for a level 7” (ULEAC, 1997b, pg. 7).

This implies that the opportunity for candidates to demonstrate their level of performance during the exam is often hindered. The examiners also argued that

“differentiation in drills is very important thus allowing the more able to spend time on the required advanced skills whilst the least able would not be expected to demonstrate those skills which they have not mastered. The increased use of time spend on the application of the skills... would improve the overall level of skill which is being demonstrated without effecting the length of the session”. (ULEAC, 1997b, pg. 7).

This rational highlights the feasibility problems of examining an “application” component through a practice-based assessment where candidates had different abilities. The fact that the performance levels of the better or least able candidates had a direct effect on the grading level needed to be considered in the light of the reliability of this method of assessment.

The teacher developed and administered oral assessments of the cognitive components (observation and analysis) have been criticised by the examiners for being “restrictive” as teachers did not ask open ended questions and instead asked specific, technical or closed questions tending to lead candidates. Examiners advised that specific questions should be used only if it is felt that the candidate is not showing enough depth in his/her answers (AEB, 1996b pg. 17; AEB, 1997b, pg. 17). These kind of criticisms lead one to question the reliability and the validity problems that are associated with the development and administration of teacher constructed assessments. Evidence of performance of students in oral assessments has not been obligatory (pre-1998) and moderators reported that they expected to see evidence of assessment procedures for the “Evidence of Understanding of Quality of Performance” component. Examiners appealed to teachers to present “photocopies of any theory material: e.g. classwork, homework or tests” (SEG, 1996a, pg. 1). It is becoming mandatory that video-taped samples of assessed work need to be made available to the moderator (SEG, 2000, pg. 13).

Thus, the existing modes of assessing the content and cognitive domains of physical activities through unseen written papers, in the performance setting and through oral assessments were questionable in terms of validity and reliability. Therefore alternatives and modifications of the existing modes of assessment were necessary to construct sound assessment instruments.

Linn and Grondlund (1995) classified tests under two main categories, objective and performance. Objective test items included multiple choice, true-false, matching, classification and short answers (Ebel and Frisbie, 1991, pg. 123). Objective tests essentially require of examinees to demonstrate specific knowledge, understanding, or skill required by the test item,

and examinees are not free to redefine the problem or organise the answer in their own words. This structured questioning and the restrictions imposed on the method of answering contribute to objective scoring that is quick, easy and accurate. However, objective tests are inappropriate for measuring the ability to select, organise or integrate ideas. Performance assessments included essay questions (extended and restricted response essay questions), oral presentations, construction of diagrams and use of equipment (Linn and Grondlund, 1995) and psychomotor components (Ebel and Frisbie, 1991, pg. 116). Performance tests can serve evaluation purposes, but they also present some unique measurement problems. Unless candidates perform the identical tasks, these cannot be compared, thus equivalent testing is necessary. The scoring on performance tests tend to be quite subjective, even when an explicit marking scheme is prepared and the preparation and administration of these tests are time consuming (Ebel and Frisbie, 1991)

The modes of assessment for assessing the content and cognitive domains were arrived at following a critical review of the existing modes of assessments in GCSE and 'A' level PE. Each mode was evaluated on four fundamental principles of PE assessments: validity, reliability, objectivity and clear criteria (Carroll, 1994 pg. 14).

The test items used for the assessment instruments were taken from past-papers and the corresponding marking schemes of the examining boards that offered questions on athletics and /or netball activities, namely, the MEG, the LEAG/ULEAC, the SEG and the WJEC (netball only). The questions of these unseen written papers were mainly of the restricted response type, and the use of a true-false question was used by the WJEC in addition to the restricted short answer type. These test items were classified as per content and cognitive domains were entered in a database.

It was concluded that the restricted written response type questions were valid and reliable modes of assessing the content and cognitive component as well as feasible and efficient to administer. Thus the unseen written paper (including diagrams) was the primary assessment tool, however, since the nature of the content was practical and there was regular use of visual demonstrations in all experimental teaching conditions, it was decided to set up a second mode of assessment, including video clips. Since oral assessments became central to the assessment of the cognitive component for the sittings of 1998, it was deemed suitable to include a third assessment mode for the purpose of comparison of marks and feedback from examinees. Thus, the three initially selected modes of assessment for the ETUs were the unseen written paper with diagrams, a video based unseen written paper and oral assessment. Each assessment was of 45 minutes duration.

The oral assessment was sampled and transcribed at pilot stage, however, it was not included in the main study mainly due to problems of feasibility of implementation. The elimination of the oral exam was justified because the inclusion of three assessment instruments of very similar questions created a situation where subjects would be unmotivated and tired of the assessments causing a testing threat to the internal validity of the study (Cohen and Manion, 1994).

For the main study two modes of assessment were used, the unseen written paper with diagrams, and a video based unseen written paper. The questions were taken from past-papers of GCSE and 'A' level PE examinations. The video clips used in the video based paper were extracted from the netball and athletics videos described in the sections on teaching resources earlier on in this chapter. These videos were allowed to be used in teaching contexts. The video based assessments of netball and athletics, included a display of the questions on screen, with a voice over reading the questions which were followed with a short video clip. The assembling and editing of the video clips was done by the researcher and technical staff at the video editing facilities of the faculties of education at the universities of Manchester and Malta and the recording facilities at the radio station of the university of Malta. The video clips were selected in relation to a group of questions. The questions were shown and read on the video before every video clip and were also provided in print on the unseen written papers that were given to the candidates. The netball video was six minutes and fifteen seconds long and the athletics video was five minutes and fifty five seconds long. The video was shown twice at the beginning of the session, with an interval of 30 seconds between each viewing and once at the end of the session.

All four papers (two for netball and two for athletics) were tested for the time limit allocated for completion. Eight undergraduate students (two for each paper) were requested to work out the paper and to note the starting and finishing time of each question on a log sheet. The time set was found to be adequately sufficient for completing all the test items. The administration time allocated was 30 minutes for the W.P. and 45 minutes for the V.P.

The following guidelines regarding adequacy of test format (Linn and Grondlund, 1995, pg. 316) were used to organise the papers.

- ◆ “grouping of items
- ◆ progression of difficulty
- ◆ numbered in sequence
- ◆ answer space (provided separate answer sheets)
- ◆ spacing, legibility, free of typographical errors
- ◆ directions of the test (clear and concise)”

These assessments were administered before and after the experimental treatment. Each subject was administered the two assessments consecutive to each other on the same day. Since the questions of the modes of assessment were very similar, it was not appropriate to allow subjects to communicate between one assessment and the other as this would have contaminated the results, so the subjects were required to get on with the second assessment immediately after the first one. During the time required for collecting and distributing the assessment sheets of the second assessment and setting up the video, candidates were required to stay in their place and were requested not to communicate with each other. The administration of both assessments took approximately one hour 15 minutes at one stretch.

Requiring all the subjects to undergo the same testing instruments irrespective of the teaching conditions, reduced the threat to external validity of the study as subjects would have been sensitised to the experimental conditions (Cohen and Manion, 1994, pg. 172). It must also be noted that the unseen written paper was administered before the video based unseen paper at both pre-test and post-test phase. This was necessitated because the video clips were likely to provide clues to the answers, thus contaminating the experimental assessment condition of the unseen written paper with diagrams. Copies of the four assessment instruments are found in appendix 3.19.

### ***3.5.2 Validation procedures of modes of assessment***

The same expert teachers who validated the teaching and assessment objectives and the content of ETUs were involved in the validation of the unseen written paper. This validation exercise required expert teachers to evaluate each test item (question and answer) of the assessment instruments against four criteria: relevance, clarity, correctness and technical soundness. The video clips of the video-based unseen written paper were evaluated for appropriateness and technical soundness by a selection of expert teachers (five for athletics and four for netball). Each test item (question and answer) was also subjected to a validation of the content and cognitive classifications.

The criteria considered for evaluating and validating the assessment instruments have been adopted from the qualities that the test developer uses to produce a good assessment. Ebel and Frisbie (1991, pg. 221) have identified an extensive list of important qualities, namely: relevance, balance, efficiency, specificity, difficulty, discrimination, variability and reliability. Linn and Grondlund (1995) put forward the following checklist criteria for evaluating a test;

- appropriateness
- relevance
- clarity
- ideal difficulty
- correctness
- technical soundness
- cultural fairness
- independence
- sample adequacy

The criteria that described the qualities for producing an assessment instrument and for checking adequacy of test items was cautiously used while the assessment instruments were being compiled. For the validation exercise it was ideal to have each test item checked on all these criteria, however, for reasons of administration and feasibility, it was decided to select some of the items. The items chosen as criteria for the validation exercise were **relevance**, **clarity**, **correctness** and **technical soundness**. The other items were regarded as either too difficult to validate by the experts (efficiency, validity, reliability, ideal difficulty, cultural fairness) or of no direct and important relevance to the study (balance, specificity, efficiency, discrimination, independence, sample adequacy). Note that appropriateness was used for validating the teaching and assessment objectives.

Expert teachers were provided with the following guiding questions to judge the test items

1. **Relevance:**  
does the item content require candidates to demonstrate the performance described in the instructional objectives and the course content?
2. **Clarity:**  
does the item present a clear and definite task to be performed?
3. **Correctness**  
is the answer correct?
4. **Technical soundness**  
is the test free from technical cues?

The sheets used for this validation exercise are available in appendix 3.10 (athletics) and appendix 3.11 (netball). Test items that scored on the agreement side of the scale (3.5 – 5) for relevance, clarity and technical soundness were retained. Correctness was treated differently. Apart from the requirement of each test item to score a mean value of 4 – 5 (absolute agreement), every expert's contribution was treated individually. When an item was rated undecided or low on the agreement side (1-3), the experts' comments of other alternatives and/or modifications to the answer were to be taken into consideration. In some cases clarifications were done with expert-teachers through verbal communication by phone.

For the athletics test items, all questions and answers scored convincingly on the agreement side of the Likert scale (4+) for relevance, clarity and technical soundness. As for correctness, some of the athletics questions received the following comments. The modifications of the answers effected are discussed in this section

*Question 3 : A sprinter changes from 100 meters to 200 meters. Give one adjustment which should be made to the starting position*

*Suggested answer as per marking scheme:*

*Any one of:*

- *Start (blocks) on the outside of the lane*

- *Straighten out the curve by placing the blocks on the outside of the lane / run at an angle to the inside of the curve*
- *place left hand about 5 cm back from the starting line*
- *adjustment of push off*

Comments referred to parts of the suggested answer to this question and included “the answer ‘adjustment of push off’ should not be regarded as an answer because the push off is more related the type of “block start”. For the same answer, another observation was that this should not be regarded as an answer because the push off is not very significant as a technique. Consequently, the answer ‘adjustment of push off’ was removed. An other observation was made on the first two answers: “Aren’t the first two answers the same? If the blocks are placed on the outside of the lane automatically the curve straightens!”. This comment was discussed with the expert teacher and it was concluded that the details of the focus of the first answer were related to the placement of the blocks whereas the second answer referred to the approaching curve. Both answers were retained.

*Question 4: The runner approaching the finishing line looks back over the right shoulder to see how near the opponent is. Is this a good procedure and why? Give two reasons.*

*Suggested answer as per marking scheme:*

*Any two from:*

- *this tactic is not to be used*
- *it is bad because runner loses time*
- *inefficient because runner cuts down on speed*

Two teacher experts observed that “this is seen happening especially in long distance events” and that “this tactic is used at professional level in heats”. It was explained to the expert teachers that the course content was entirely on sprints and that the title sprints would appear on the test paper. The experts changed their rating to “correct” (4). Another commented that the last two answers mean the same thing i.e. that the runner loses time because of the reduction of speed. It was explained that the time and the speed were treated as separate reasons justifying the effect. No changes were effected to the answer of this question.

*Question 7: Figure 1 is a diagram of a sprinter’s action. List one characteristic of good sprinting technique with reference to each of the following phases:*

1. *head carriage*
2. *posture*
3. *arm action*
4. *leg action*

One respondent commented that other answers could be accepted such as:

*7a add answer avoid shifting head from side to side*

*7b add answer: run perpendicular to the ground*

*7c add answer: elbows held at 90°*

*7c add answer: sweep hands up to eye level and down to the hips*

These answers were incorporated in the marking scheme.

*Question 10: In a relay race, what use should be made of the 10 meters before the changeover box?*

*Suggested answer as per marking scheme:*

- *outgoing runner can gain speed before the box*
- *incoming runner runs at top speed*

Other acceptable answers were suggested such as “the outgoing runner has to run at top speed” and “the incoming runner maintains top speed”. The answer of this question was modified to:

- *outgoing runner can gain speed before the box*
- *the outgoing runner has to run at top speed*
- *incoming runner runs/ maintains (at) top speed*

The netball test items also scored convincingly on the agreement side of the Likert scale (4+) for relevance, clarity and technical soundness. As for correctness the following questions required modifications.

*Question 3: How should a defending player try to intercept a shot? Give two points*

*Suggested answer as per marking scheme: Any two from*

- between the attacker and the goal post*
- a sideways stance/ at right angles to the shooter*
- lean towards the shooter with arm outstretched towards the ball / in the path of the ball*
- on balls of feet*

Two expert teachers observed that none of the above will be technically correct unless the defending player was 3 feet away from the landing foot of the player attempting a shot. Thus, another possible answer was added:

- take a position three feet away from the landing foot of the shooter*

*Question 6:* The diagram on the marking sheet was small and two respondents needed to be supplied with the actual test paper, where the diagrams were much more clear.

The validations of the netball and athletics videos used in conjunction with the video-based unseen written papers were also validated by expert teachers (five for athletics and four for netball). These validation procedures were administered to expert teachers individually on separate occasions. Experts were requested to read the series of questions that went with each video clip and then they had to evaluate every test item for appropriateness and technical soundness. The guiding questions presented to the expert teachers to assist them in their evaluation were;

**1. Appropriateness:**

- 1.1 Is the motion picture presented appropriate to use with the question/s?

**2. Technical Soundness:**

- 2.1 Is each video clip [question/s and motion picture] free from technical errors or irrelevant clues?

(see appendix 3.20 (athletics) and appendix 3.21 (netball)).

These teachers were also requested to write any comments and observations of the video clips. These were discussed with the researcher at the end of the session. Video clips that scored on the agreement side of the scale (3.5 – 5) for both appropriateness and technical soundness were retained.

The video clips for athletics were all considered very appropriate and technically sound as they all scored well above the set criteria of a mean of 3.5 on the five point Likert scale. However, two experts observed that with regards to video clip 7- question 12 (Give **three** rules which you would apply to throwing events to ensure the safety of both competitors and spectators) there weren't any spectators shown in the video clip. This video clip was changed to one including both officials and spectators in the vicinity of the shot putter.

The netball video clips all received convincing affirmative approval for appropriateness and technical soundness as each question scored between 4-5. No changes were effected to the netball video clips.

A common observation that emerged from some of the experts for both athletics and netball was that the video clips did not provide the answer to the question and that some of the clips were short. However, given that subjects were allowed to view the video clips twice a the beginning and once at the end of the session, the experts accepted that the candidates had adequate opportunities to view the video clips, jot down notes and double check at the end.

The validation of the content (technique, tactics and rules) and cognitive (knowledge and comprehension, application and analysis, synthesis and evaluation) domains, required of experts to read each test item (the question and answer) from the provided marking scheme and to tick one of the three content domains and one of the three cognitive domains. The experts were presented with a copy of two tables taken from Linn and Grondlund, (1995, pg. 534, 535) describing the major categories of Bloom's cognitive domain, the relevant objectives and the illustrative verbs stating specific learning outcomes. The validation of the cognitive domain was anticipated to be somewhat problematic, for various reasons. Firstly, the illustrative verbs provided by Linn and Grondlund (1995) were not exclusive and the authentic test items taken from past-papers did not include the same verbs. Also, as stated earlier on in this chapter, some of the illustrative verbs provided in the table provided to assist in the validation exercise, appeared in more than one classification even though the six categories had been collapsed into three bi-partite streams. The illustrative verbs that were repeated in more that one category of Bloom's classifications and the respective cognitive categories were:

*describes*- knowledge and evaluation *distinguishes*- comprehension and analysis; *relates*- analysis and synthesis; *selects*- knowledge and analysis; *summarises*- comprehension and synthesis.

Ebel and Frisbie (1991) stated that although cognitive taxonomy is useful for classifying objectives in terms of level of behaviour required, it is much less useful for classifying test items as it is very difficult to pinpoint the mental processes involved in answering a particular test question, even when we know what took place during instruction. To address this problem Ebel (1965) created a categorisation system to be used with test items instead of objectives, a system which depended on observable operations instead of mental processes. Ebel's Relevance Guide included seven categories: terminology, factual information (corresponded to Bloom's (1956) knowledge), explanation (corresponded to Bloom's (1956) comprehension), calculation, prediction (corresponded to Bloom's (1956) application), recommended action and evaluation (also in Bloom's (1956) evaluation). Nevertheless this classification was not directly useful for the study since the instructional objectives stated explicit cognitive content outcomes.

The validation of the content classification of the items (technique, tactics and rules) reached undisputed consensus for all test items of athletics and netball. However, the classification of test items for the cognitive domains classification (knowledge and comprehension, application and analysis, synthesis and evaluation) was problematic as each test item was often classified as belonging to more than one of these three cognitive streams according to the experts. This implied that the cognitive classification applied to each test item and groups of test items in the analysis need to be treated with caution. For the content and cognitive classification of each test item see appendix 5.2 and for the validation exercise see appendix 3.22.

### ***3.5.3 Marking of the scripts***

The marking of the netball and athletics pre-test and post-test scripts was done by trained markers and not by the author. This was necessary because the author had been engaged in the implementation of the ETUs and was therefore likely to cause a threat to the internal validity of the study by expecting or anticipating that some subjects or a particular teaching condition contributing to better performance (Thomas and Nelson, 1996). This would also have been a potential threat to the external validity of the study as the researcher might have being sensitised or sympathetic to the experimental teaching conditions (Cohen and Manion, 1994). The markers were final year (fourth year) B.Ed. students, who had PE as one of their two main subjects. The markers had done pedagogic and content courses on athletics and netball. Before the marking exercise, training was given to the markers to explain and instruct them to apply the marking criteria of two marking schemes [theory and video-based written papers] when marking scripts of

either of two physical activities [Athletics or Netball]. The author was the trainer, who devised a training programme. The training involved a series of exercises over two sessions of one and half-hours each. The scripts used during these exercises were selected at random from the post-test papers of the three experimental conditions for each of the two physical activities and were photocopied. The markers were provided with the revised marking schemes (see appendix 3.23 (athletics) and 3.24 (netball)), and the marking sheets required for the marking of the scripts (see appendix 3.25 (athletics) and appendix 3.26 (netball)). Details of the two training sessions are given in appendix 3.27.

The marking was done in a room adjacent to the researcher's office, where markers had fixed hours each week when they could come. The researcher made the scripts available at the beginning of each session and was accessible in the room next door each week for any problems or clarifications. The markers were also provided with marking sheets for the two modes of assessment and stationery. The administrative sheets were kept in the marker's wallet files, and were collected by the researcher together with the scripts at the end of each weekly marking session. Each netball marker marked four scripts for each of the 48 subjects whereas each athletics marker marked four scripts for each of the 49 subjects. The four scripts comprised two pre-tests and two post-tests.

After all the marking was finished the author could either use a method of multiple markers or select the most reliable marker for each physical activity. Since there were a substantial amount of markers, especially in the case of athletics, it was decided to select the most reliable marker for each physical activity. This was achieved by calculating measures of inter-marker reliability (Siedentop, 1991) for a series of randomly selected number of post-test scripts marked (72 sub-scores). When the netball-markers' scores were compared, there was one marker who achieved 100% reliability when compared to any other of the markers, while all other couple combinations yielded inter-marker reliability scores ranging between 84% and 92%. This also showed that the netball-marking scheme was very high on reliability. The same procedure was applied to the athletics markers and there emerged one marker who scored consistently high on inter-marker reliability when compared with three other markers (85%, 90% and 94%). The marking of this athletic marker was used for the purpose of analysing data.

#### ***3.5.4 Analysis of the modes of assessments***

The analysis of the athletics and netball pre-test and post-test unseen and video based written papers were to be analysed using qualitative analysis, quantitative analysis, and inferential statistics.

#### *3.5.4.1 Qualitative analysis*

The scripts of the unseen written papers (W.P.) and the video based unseen written papers (V.P.) were analysed to identify the impact (if any), of the use of diagrams and videos on the quality of the answers given by the subjects. These were related to the experimental teaching conditions. The subjects' opinions about the experimental teaching conditions and modes of assessments were reported after the subjects filled in evaluation sheets that were circulated a week after the post-test (see appendix 3.28).

#### *3.5.4.2 Descriptive Statistics*

Means and standard deviations are reported for the whole sample and for the netball and athletics groups separately by the independent variables and their combinations on the dependent variables. This enabled the partitioning of the data to be examined and comparisons among the physical activities, content and cognitive domains.

#### **Independent variables**

1. Physical activity: netball vs. athletics
2. Experimental teaching condition: conditions 1 (practice based sessions) vs. condition 2 (practice based sessions and handout) vs. condition 3 (class based sessions)
3. Gender: female vs. male
4. Attendance: all sessions vs. missed one session
5. Activities of participation: netball / athletics vs. no participation in netball / athletics
6. Activities of participation: participation in other physical activities vs. no participation

#### **Dependent Variables**

Scores on each of the dependent variables were collected on two occasions: Occasion 1, the pre-test, which was conducted a week before the commencement of the ETUs; and Occasion 2, the post-test, which took place a week after the end of the sessions. These scores were collected individually for each subject participating in the study and were arrived at by collapsing the marks of the questions classified according to the respective content and cognitive domains. The list of dependant variable used in the study is given below.

1. Total Score unseen written paper
2. Total Score video based unseen written paper

#### *Unseen written paper*

3. Sub-score: rules - unseen written paper
4. Sub-score: tactics - unseen written paper
5. Sub-score: techniques - unseen written paper
6. Sub-score: knowledge - unseen written paper
7. Sub-score: application - unseen written paper
8. Sub-score: analysis - unseen written paper
9. Sub-score: techniques & knowledge – unseen written paper
10. Sub-score: techniques & application – unseen written paper
11. Sub-score: techniques & analysis – unseen written paper
12. Sub-score: tactics & knowledge – unseen written paper
13. Sub-score: tactics & application – unseen written paper

- 14.Sub-score: tactics & analysis – unseen written paper
- 15.Sub-score: rules & knowledge – unseen written paper
- 16.Sub-score: rules & application – unseen written paper
- 17.Sub-score: rules & analysis – unseen written paper

*Video based unseen written paper*

- 18.Sub-score: techniques - video based unseen written paper
- 19.Sub-score: tactics - video based unseen written paper
- 20.Sub-score: rules - video based unseen written paper
- 21.Sub-score: knowledge - video based unseen written paper
- 22.Sub-score: application - video based unseen written paper
- 23.Sub-score: analysis - video based unseen written paper
- 24.Sub-score: techniques & knowledge – video based unseen written paper
- 25.Sub-score: techniques & application – video based unseen written paper
- 26.Sub-score: techniques & analysis – video based unseen written paper
- 27.Sub-score: tactics & knowledge – video based unseen written paper
- 28.Sub-score: tactics & application – video based unseen written paper
- 29.Sub-score: tactics & analysis – video based unseen written paper
- 30.Sub-score: rules & knowledge – video based unseen written paper
- 31.Sub-score: rules & application – video based unseen written paper
- 32.Sub-score: rules & analysis – video based unseen written paper

*3.5.4.3 Inferential Statistics*

To test the major experimental hypotheses, analysis of variance (ANOVA) and t-tests were performed on the post-test scores of the W.P. and the V.P of the two physical activities. A multiple analysis of variance MANOVA (repeated measures) was performed on the two assessment occasions for each of the W.P. and the V.P. too.

This study focused on the experimental teaching conditions and their impact on the content and cognitive domains and the type of physical activity. It was hypothesised that experimental teaching condition 3 (class-based teaching) provided more opportunities for the subjects to master the content knowledge and cognitive skills of both the athletic type activity and the game type activity. It was also hypothesised that the classes of experimental teaching condition 1 (practice-based) and 2 (practice-based and handout) would be at a disadvantage to those of experimental teaching condition 3 (class-based) for the assessments. This was anticipated because the subjects of experimental teaching conditions 1 and 2 had not been exposed to any written activities during their sessions.

**3.6 Experimental and null hypothesis**

Ho (1) *non-directional null hypothesis*: Physical activity: netball vs. athletics

There will be no significant difference between the mean scores of the subjects in netball or athletics classes on any of the dependent variables<sup>1</sup>.

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<sup>1</sup> The dependent variables include the total scores and the sub-score of the content (techniques, tactics, and rules) and cognitive (knowledge, analysis and evaluation) components and their combinations for the W.P. and the V.P.

- H1 (1) *alternative non-directional hypothesis*: Physical activity: netball vs. athletics  
There will be a significant difference between the mean scores of the subjects in netball or athletics classes on any of the dependant variables.
- Ho (2) *non-directional null hypothesis*: Experimental teaching conditions  
There will be no significant difference between the mean scores of the subjects in the three experimental teaching conditions on any of the dependent variables.
- H1 (2) *alternative non-directional hypothesis*: Experimental teaching conditions  
There will be a significant difference between the mean scores of the subjects in the three experimental teaching conditions on any of the dependent variables.
- Ho (3) *non-directional null hypothesis*: Gender  
There will be no significant difference between the mean scores of the male and female subjects on any of the dependant variables.
- H1 (3) *alternative non-directional hypothesis*: Gender  
There will be a significant difference between the mean scores of the male and female subjects on any of the dependant variables.
- Ho (4) *non-directional null hypothesis*: Participation in physical activities: (athletics or netball)  
There will be no significant difference between the mean scores of the subjects who participate in athletics or netball and those who do not participate on any of the dependant variables.
- H1 (4) *alternative non-directional hypothesis*: Participation in physical activities: (athletics or netball)  
There will be a significant difference between the mean scores of the subjects who participate in athletics or netball and those who do not participate on any of the dependant variables.
- Ho (5) *non-directional null hypothesis*: Participation in other physical activities  
There will be no significant difference between the mean scores of the subjects who participate in other physical activities and those who do not participate on any of the dependant variables.
- H1 (5) *alternative non-directional hypothesis*: Participation in other physical activities  
There will be a significant difference between the mean scores of the subjects who participate in other physical activities and those who do not participate on any of the dependant variables.
- Ho (6) *non-directional null hypothesis*: Assessment mode  
There will be no significant difference between the mean scores of the subjects' unseen written paper and video based unseen written paper at pre-test and post-test respectively on any of the dependant variables.
- H1 (6) *alternative non-directional hypothesis*: Assessment mode  
There will be a significant difference between the mean scores of the subjects' unseen written paper and video based unseen written paper at pre-test and post-test respectively on any of the dependant variables.
- Ho (7) *non-directional null hypothesis*: Occasions of testing  
There will be no significant difference between the mean scores of the subjects from the pre-test to the post-test on any of the dependant variables.
- H1 (7) *alternative non-directional hypothesis*: Occasions of testing  
There will be a significant difference between the mean scores of the subjects from the pre-test to the post-test on any of the dependant variables.

- Ho (8) *non-directional null hypothesis*: Interaction effects  
 There will be no significant interaction between one or more combinations of the independent variables in relation to the mean scores on any of the dependant variables.
- H1 (8) *alternative non-directional hypothesis*: Interaction effects  
 There will be a significant interaction between one or more combinations of the independent variables in relation to the mean scores on any of the dependant variables.
- Ho (9) *non-directional null hypothesis*: CAFIAS behaviour categories  
 There will be no significant differences between CAFIAS behaviour categories and the independent variables of physical activities and ETUs.
- H1 (9) *alternative non-directional hypothesis*: CAFIAS behaviour categories  
 There will be significant differences between CAFIAS behaviour categories and the independent variables of physical activities and ETUs
- Ho (10) *non-directional null hypothesis*: Bloom's cognitive domains  
 There will be no significant differences between the scores of the cognitive domains of Bloom's Taxonomy and the six domains are not hierarchic.
- H1 (10) *alternative non-directional hypothesis*: Bloom's cognitive domains  
 There will be significant differences between the scores of the cognitive domains of Bloom's Taxonomy and the six domains are hierarchic.

The term “significant” as used in the above hypotheses is operationally defined as allowing for a statistical significance of  $p < 0.05$ . The phrase “statistically significant” will be used in the discussion of the results. One must note that statistical significance does not always have educational or practical importance and likewise, even when statistical significance does not result in the analysis, there may be significant educational or practical implications.

### 3.7 The pilot study

The primary aim of the pilot study was to test out the feasibility of implementation of the three experimental teaching conditions, for three physical activities and administering three experimental modes of assessment to each subject. As has been explained in section 3.3.1.1, the recruitment of the subjects reduced the pilot study to the application of the experimental teaching conditions and the experimental modes of assessment for one physical activity, netball.

There were seventeen students for experimental teaching condition one (practice-based class), ten for experimental teaching condition two (practice-based class and a handout) and seven for the third (class-based sessions). The first two classes were in one school and the third one was in another. All the sessions were of one hour duration and each ETU was of five hours.

The first task was to develop teaching documentation, namely, schemes of work (SOW), lesson notes, handouts and classwork sheets. Another job was to view and locate relevant video clips to

be used in the class-based sessions. Caution was taken to generate the same teaching situations across the ETUs, in spite of the different teaching environments. These were used in the main study and can be found in appendix 3.13. The subjects were also given evaluation sheets (see appendix 3.28) at the end of the course to comment on the modes of teaching and the modes of assessment. The sessions were not filmed at piloting phase.

At piloting stage, the three experimental modes of assessments were administered to the subjects (unseen written paper, video based unseen written paper and audio recorded oral assessment), however, for the oral assessment, it was decided to select a sample of the questions given in the unseen written paper. This was done because it was not feasible (in terms of time) to have the three assessments done in the time allocated for the session. This also led to a decision to reduce the time and the number of the test items for both modes of assessment such that the two assessments could be administered in a session of 1 hour 15 minutes, as this was the time allocated to the weekly sessions. This was effected for the main study without altering the mark-weighting of test items in relation to the content and cognitive domains. Thus, the number of test items in each paper was reduced, without altering the marks of the table of specifications. The time of the assessment was reduced to 30 minutes for the unseen written paper and retained at 45 minutes for the video based unseen written paper. This was done to allow for the extra time required for the viewing of video clips twice at the start of the assessment (with a pause of 30 seconds between each viewing) and a third viewing at the end of the assessment.

The number of subjects who completed the entire experimental teaching treatment and two of the three modes of assessment was very low (three subjects for experimental teaching condition one, six subjects for experimental teaching condition two and one subject for experimental teaching condition three). Only four subjects did the oral assessments. This limited data did not qualify for preliminary statistical data analysis. However, qualitative analysis of the experimental modes of assessment and the feedback provided through informal discussions with the subjects and the student evaluation sheets were very useful. Some students suggested that the video exam could have some sound, namely, to include a voice over the exposition of the questions appearing on screen prior to the viewing of the video clips. This was effected. Following a discussion and written feedback from the subjects involved in the pilot study, it transpired that the three experimental modes of teaching and the two written based assessments were found to be relevant. Subjects in the class-based teaching condition were encouraged to participate in the netball practical sessions organised by the school though. Subjects showed a preference towards the video based written paper, however the use of more diagrams for the unseen written paper was suggested too. Only a few found the idea of an oral exam a good alternative to the written mode of assessment. This implied that the experimental teaching conditions and the modes of

assessments did not pose any serious threats to the face validity of the teaching – assessment dimension (Linn and Grondlund, 1995) of the experimental design.

It was also the intention of the exercise to investigate how a subject would do when presented with open ended questions in an oral assessment as suggested by the examiners' reports (AEB, 1996b pg. 17; AEB, 1997b, pg. 17) as opposed to objective questions requiring short written answers (Ebel and Frisbie, 1991, pg. 123). Thus, qualitative analysis was done on the questions selected from the unseen written papers, which were also used for the oral assessments (see appendix 3.29 and appendix 3.30). The oral assessments lasted between 2.5 to 10 minutes for each of the four subjects. At the end of the oral assessment, the subjects were requested to rate their perceived performance for each of the two modes of assessments.

For the open ended question related to playing the ball rule (No 13), subjects gave between two to five responses whereas for the written question all candidates had to reply to six situations. It must be observed that reasons given were awarded full marks (2) in the oral assessment only if a complete answer was given (e.g. roll the ball alone was awarded 1 mark, whereas roll the ball on the floor to another player would be awarded 2 marks). In the written paper, all subjects scores lower on this question because they were brief in their answer (e.g.: Free Pass), omitting expected details such as (to the opposing team (0.5 marks)) where the infringement occurred (0.5 marks). On this question, two subjects scored higher on the written paper, and one candidate got the same marks for both modes of assessment in spite of offering three reasons for the oral assessment. The fact that subjects were not tested for specific situations in the oral exams, or asked to mention a specific number of situations, made the assessment subjective. A separate marking scheme needed to be used for this question for the oral assessment.

The question on the positional responsibilities of the Wing Attack was a case of the same question being asked in writing and orally. Two candidates scored higher on the written paper for this question and the other two on the oral assessment. Only one subject (candidate 3) was correct about the perceived competence (i.e. believing to have achieved higher scores on the written or oral assessment) for answering this question. All candidates but one scored just higher (1 – 0.5 difference) on the oral assessments (in total).

It must be noted that the second question asked to each candidate in the oral exam was not included in the unseen written paper. This was done so that the test items of the assessment instruments would not be a replica of each other. However this strategy was not used for the unseen written papers, mainly due to the time factor, however the order of the questions was switched and the wording of the questions was changed for some test items.

From the pilot study, the subjects confirmed the face validity of the experimental teaching and assessment conditions. The brief analysis of the written and oral questions highlighted the complexity of the administration of modes of assessments and their interpretation. Piloting one physical activity provided the opportunity of improving and refining the teaching and assessment instruments, without having to replicate work for the other activity.

### **3.8 Limitations of research generalisability**

The studies included a representation of the Maltese population of first year Sixth-Form students for the scholastic years 1996-1997 and 1997-1998. However, the number of subjects in each experimental group was very modest given a total population of 3,812 of first and second year students from seven schools. These students received five years of National Curriculum PE before the experimental treatments, and none had been through a course of GCSE PE, which has been taught only in one school in Malta (van Vuuren-Cassar, 1998).

The modes of assessments and methods of teaching in PE used in these studies do not fully correspond with those of an assessed course at GCSE and 'A' level PE and Sport Studies. This limits the results to the experimental teaching and assessment conditions used in the investigation with reference to the relevant performance coursework of athletic and game type activities only. The limited time of the experimental teaching unit did not allow for the application and synthesis of sport science knowledge to performance coursework. No claims are being made about students taking GCSE and 'A' level in PE or Sport Studies.

## CHAPTER 4

### RESULTS OF THE EXPERIMENTAL TEACHING UNITS

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#### 4.1 Introduction

The results of the first study, the experimental teaching units (ETUs) will be presented in this chapter. The findings of the athletics and netball ETUs, using CAFIAS categories and parameters will be disclosed. These will describe what went on in the ETUs in terms of teacher and pupil behaviours and content with respect to the three experimental teaching conditions. The objective of this part of this chapter is to identify any differences and similarities that the experimental teaching conditions exerted on the physical activities, the content, the teacher and the pupils. Adjusted residuals (Hutcheson and Sofroniou, 1999) will be used to measure the significance of any differences between teacher and student CAFIAS behaviours across the six experimental teaching conditions and the physical activities.

#### 4.2 Experimental Teaching Units

The findings of the ETUs for athletics and netball will be presented separately in the following sections. The percentage of time spent on each of the twenty CAFIAS categories across the three experimental teaching conditions will be described. The most frequent interaction patterns occurring in each experimental teaching condition will be discussed while CAFIAS parameters, measuring teacher and pupil interactions, time on content and teaching environments provide details of what went on in each physical activity and experimental teaching condition. A comparison between the two physical activities across the experimental teaching conditions will indicate if there are any trends in the interaction patterns of different activities.

##### *4.2.1 Experimental Teaching Units: Athletics*

The three ETUs in athletics comprised six hours of contact teaching time. In the ensuing discussion the experimental teaching conditions will be referred to as follows:

**A1:** Physical Education: Athletics (practice-based sessions); ETU 1

**A2:** Physical Education Coursework Athletics: (practice-based sessions and handout); ETU 2,  
and

**A3:** Sport Studies Athletics: (class-based sessions); ETU 3.

There were two classes who underwent the ETUs for each of A1 and A2 and one class for A3, five classes in total. The classes comprised co-educational 16-year-old first year students at post-secondary educational institutions with the exception of one class, which included male students. The classes' average attendance of students for each of the athletics ETUs was as follows: A1-

class 1: 13 students; A1- class 2: 4 students; A2-class 1: 16 students; A2-Class 2: 16 students; and A3: 15 students.

Although all the lessons of the five athletics classes were recorded only the entire sessions of one class from each experimental teaching condition (A1, A2, and A3) was used for recording of observations using CAFIAS analysis. The criterion used for selecting the classes for the purpose of CAFIAS analysis was to give priority to classes that had been filmed throughout the lessons without recording mishaps.

There occurred some technical mishaps while recording the sessions and in the case of A1, the first session of 1 hour 30 minutes duration was not filmed due to video camera scheduling problems for week one. As a solution, the first two sessions of the second class of A1, which underwent the same ETU, were analysed instead. The sessions of the second class were of 1 hour duration, however the school policy of allowing 15 minutes for changing and showering, brought the actual time of these lessons to 1 hour 30 minutes. The volunteer teacher delivered this session. The sessions of the second class of A1 were not used for the purpose of analysis as the last two sessions were cut short of filming due to inclement weather and fear of damaging the cameras. The lessons still took place though. Another technical fault during the recording of the first session of A3 resulted in filming just 19 minutes from the entire session. This session was repeated and recorded with another class.

#### 4.2.1.1 CAFIAS categories: athletics

The teacher and student behaviours are identified by categories 2-20 in table 4.1. The table includes details of the category descriptions and the actual recorded observations (*N*) and the percentage of each category in relation to total class time for each of the three ETUs; A1, A2 and A3.

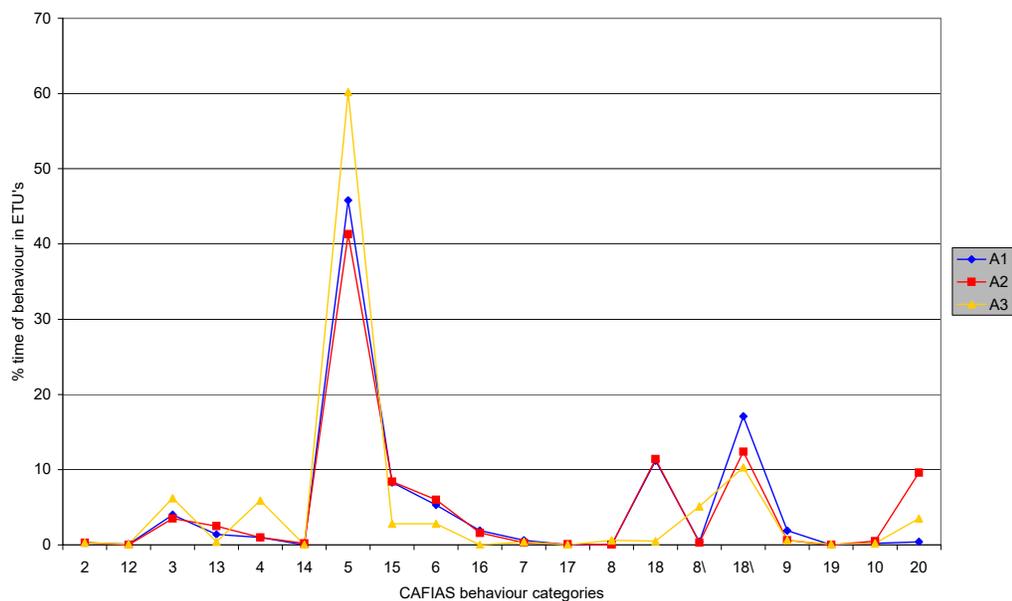
Table 4.1: CAFIAS categories of the experimental teaching conditions in athletics.

Category	Categories descriptions	A1		A2		A3	
		<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
	<b><i>Teacher Behaviours</i></b>						
2	Praises or Encourages - Verbal	17	0,30	12	0,26	11	0,27
12	Praises or Encourages - Non-verbal	7	0,12	1	0,02	3	0,07
3	Accepts or Uses Ideas of Students – Verbal	226	4,03	161	3,50	255	6,17
13	Accepts or Uses Ideas of Students – Non-verbal	78	1,39	115	2,50	18	0,44
4	Asks Questions – Verbal	57	1,02	45	0,98	243	5,88
14	Asks Questions – Non-verbal	0	0,00	7	0,15	1	0,02
5	Gives Information – Verbal	2573	45,84	1898	41,31	2487	60,19
15	Gives Information – Non-verbal	467	8,32	387	8,42	117	2,83
6	Gives Directions – Verbal	299	5,33	277	6,03	115	2,78
16	Gives Directions – Non-verbal	105	1,87	75	1,63	1	0,02

Category	Categories descriptions	A1		A2		A3	
		N	%	N	%	N	%
7	Criticises or Justifies Authority – Verbal	31	0,55	14	0,30	18	0,44
17	Criticises or Justifies Authority – Non-verbal	1	0,02	3	0,07	0	0,00
	<b>Student Behaviours</b>	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
8	Student Predictable Response – Verbal	2	0,04	1	0,02	25	0,61
18	Student Predictable Response – Non-verbal	631	11,24	525	11,43	22	0,53
8\	Student Interpretative Behaviour – Verbal	21	0,37	14	0,30	210	5,08
18\	Student Interpretative Behaviour – Non-verbal	961	17,12	568	12,36	427	10,33
9	Student Initiative Behaviour – Verbal	106	1,89	29	0,63	25	0,61
19	Student Initiative Behaviour – Non-verbal	0	0,00	0	0,00	3	0,07
10	Confusion, Disorder, Noise	10	0,18	22	0,48	8	0,19
20	Silence	21	0,37	440	9,58	143	3,46
	Total	5613	100,00	4594	100,00	4132	100,00

The percentages of time spent on CAFIAS behaviour categories for the three athletics ETUs are also presented in diagrammatic form in figure 4.1

Figure 4.1: Percentages of time spent on CAFIAS behaviour categories for the three athletics ETUs.



The teacher verbal and non-verbal behaviours (categories 2-17) were similar across the three experimental teaching conditions as far as praise and encouragement (categories 2-12) and giving criticism (categories 7-17) were concerned. The acceptance and use of students' verbal ideas (category 3) was slightly higher in A3, (6.17%) the class-based session. In contrast the acceptance of non-verbal ideas of pupils (category 13) was higher in A1 (1.39%) and A2 (2.50%). The use of

verbal questions (category 4) as expected was relatively higher in A3 (5.88%) as the class-based session lends itself to more opportunities of verbal exchange. There was very little use of questioning in A1 (1.02%) and A2 (0.98%). The time spent on giving verbal information and lecturing (category 5) was also higher in A3 (60.19%) in comparison to A1 (45.84%) and A2 (41.31%). The demonstrations of activities categorised as giving non-verbal information (category 15) were higher in A1 (8.32%) and A2 (8.42%); the practice-based classes, in comparison to A3 (2.83%). The instances of giving directions (categories 6-16) were higher for A1 (5.33%, 1.87%) and A2 (6.03%, 1.63%) in the practice-based sessions.

The student's verbal predictable response (category 8) behaviours were similar for all three ETUs. The student non-verbal predictable response (category 18) was much higher for A1 (11.24%) and A2 (11.43%) as in the practice-based sessions students spent more time getting organised for practices than in the class-based session A3 (0.53%). The student verbal interpretative behaviour (category 8\ ) was higher for A3 (5.08%) and hardly evident in A1 (0.37%) and A2 (0.30%). Student non-verbal interpretative behaviour (category 18\ ) as expected was higher in the practice based sessions A1 (17.12%) and A2 (12.36%) as students were engaged in practising activities. In A3 some time was also spent on non-verbal interpretative activities such as classwork exercises (10.33%). It must be noted that these percentages do not represent the actual engagement time (motor and cognitive activities) of the students. There were instances when the class was working (practice and classwork activities) and the teacher went round giving feedback, encouragement and information to individual students, and in these cases, the teacher's behaviour only was recorded although the remainder of the class was actively engaged. In this sense CAFIAS has a limitation of not being the right measurement instrument to gauge student engagement time precisely.

Student initiated behaviour (categories 9-19) was low across all experimental teaching conditions, however students in A1 (1.89%) took more initiative than those in A2 and A3. Confusion and disorder, as expected was very low, however, silence was unexpectedly evident due to students taking time to come to class with A2 (9.58%) having taken most time of all. The total value of tallies for each experimental teaching condition (A1- 5613, A2-4594, A3-4132) account for the recorded behaviours at intervals of three seconds. When transposed into hours, the lesson time recorded was 4.67 hours for A1, 3.83 hours for A2 and 3.44 hours for A3.

#### *4.2.1.2 Frequent interactions: athletics*

CAFIAS allows for the generation of the most frequent interactions patterns using a 20x20 matrix enabling the division of verbal and non-verbal behaviours (Cheffers *et al.*, 1980, pg. 58) and the 60x60 matrix providing further information on the teaching agent, namely the teacher

(t), student (s) and the environment (e). The latter was regarded as a more informative measure of interaction and was used to analyse the data.

The most frequent interactions of the three experimental teaching conditions in athletics are tabulated in table 4.2. The top ten cells from the 60x60 matrix are presented in rank order and details of the number of frequencies, the percentage of each interaction from the total time of the ETU and the categories of pair behaviours representing the interactions are also given in the table.

Table 4.2: Interaction patterns of experimental teaching units in athletics

Rank	A1 N=5613	%	Categories	A2 N=4594	%	Categories	A3 N=4132	%	Categories
1	1680	29,9	5t-5t	964	21,0	5t-5t	1487	36,0	5t-5t
2	683	12,2	18\s-18\s	425	9,3	20t-20t	595	14,4	5e-5e
3	404	7,2	15t -5t	387	8,4	18\s-18\s	333	8,1	18\s-18\s
4	393	7,0	18s-18s	359	7,8	18s-5t	128	3,1	20t-20t
5	357	6,4	5t-15t	339	7,4	5t-15t	120	2,9	4t-5t
6	133	2,4	18\s-5t	320	7,0	18s-18s	98	2,4	3t-3t
7	130	2,3	5t-18\s	229	5,0	5e-5e	94	2,3	5t-3t
8	119	2,1	5t-18s	109	2,4	5t-18s	76	1,8	15t-5t
9	108	1,9	6t- 6t	107	2,3	3t-3t	74	1,8	3t-8\s
10	96	1,7	3t-3t	93	2,0	6t-6t	72	1,7	5t-15t

In A1 (5t-5t), extended teacher verbal information giving (29.9%) was the most frequent interaction followed by (18\s-18\s), extended student non-verbal interpretative behaviour (12.2%) where students were actively engaged interpreting teacher suggested activities such as practising athletics skills. Student interpretative response in class activities was followed by the teacher's verbal information giving (18\s-5t)-(2.4%) and teacher verbal information giving was followed by students' interpretative behaviours ((5t-18\s), 2.3%). Teacher information giving was also followed by students predictable response ((5t-18s), 2.1%) such as getting into groups. The use of (15t-5t) teacher non-verbal demonstration of activities and extended verbal explanation (7.2%), and (5t-15t), the use of teacher verbal giving of information followed by non-verbal demonstrations (6.4%) was a procedure used in this ETU. Student non-verbal predictive response (18s-18s), such as following a teacher direction and getting organised in group formations for practices amounted to 7.0%. Directions given by the teacher verbally (6t-6t) accounted for 1.9% while the teacher's acceptance, clarification and use of students' ideas (3t-3t) totalled 1.7%.

In A2 extended teacher verbal information giving ((5t-5t), 21.0%) was the highest interaction followed by (20t-20t), where the teacher waited in silence for the class to turn up (9.3%). Student non-verbal interpretative behaviour (18\s-18\s) where students were actively engaged interpreting teacher suggested activities such as practising athletics skills amounted for 8.4%.

Student non-verbal predictive response (18s-18s), such as following a teacher direction and getting organised in group formations for practices amounted to 7.0%. The instances of students getting organised in groups was followed by the teacher giving information (18s-5t), implying that the teacher was consolidating the teaching points to be practised (7.8%). The teacher extended verbal information giving was followed with students getting organised into practice activities ((5t-18s), 2.4%). The use of teacher verbal giving of information followed by non-verbal demonstrations ((5t-15t), 7.4%) was a procedure used in this ETU. The use of the environment as a teaching agent (5e-5e) was used in these sessions (5.0%) through the use of handouts emphasising the main skills, rules and tactics taught in each lesson. The teacher's verbal acceptance, clarification and use of students' ideas (3t-3t) totalled 2.3%. Directions given by the teacher verbally (6t-6t) accounted for 2.0%.

In A3 the use of extended teacher verbal information giving ((5t-5t), 36.0%) was the highest interaction followed by ((5e-5e), 14.4%) where the environment in the form of video clips and handouts were sources of teaching. The use of (15t-5t) teacher non-verbal demonstration of activities and extended verbal explanation (1.8%), and (5t-15t), the use of teacher verbal giving of information followed by non-verbal demonstrations (1.7%) was a procedure used in this ETU. The use of questions followed by teacher information giving (4t-5t) was used (2.9%) while extended teacher information giving was followed by the teacher's acceptance and development of students' ideas ((5t-3t), 2.3%). The teacher's verbal acceptance, clarification and use of students' ideas (3t-3t) totalled 2.4%. Teacher acceptance of student ideas was followed by student verbal interpretative behaviour (3t-8\s) as the teacher entered into dialogue with the students (1.8%). Student non-verbal interpretative behaviour (18\s-18\s) where students were actively engaged interpreting teacher-suggested activities such as completing classwork written exercised amounted to 8.1%. The teacher waited in silence for the class to turn up (20t-20t) - (3.1%).

When the interaction patterns of the three athletics ETUs are compared the following conclusions can be drawn:

1. The highest ranked interaction across all three ETUs was (5t-5t), where extended teacher verbal information was given during the session. More time was spent on information giving in A3 (36.0%) in comparison to A1 (29.9%) and A2 (21.0%).
2. The use of the environment as a teaching agent (5e-5e) was highest in A3 (14.4%) followed by A2 (5.0%). The use of the environment as a teaching agent was not frequent in A1.

3. The use of verbal information giving that was followed with non-verbal demonstration of activities (5t-15t) was a frequent pattern in A1 (6.4%) and A2 (7.4%), and it was lower in A3 (1.7%).
4. The use of non-verbal demonstrations that were followed with verbal information giving was frequent in A1 (7.2%) and lower in A3 (1.8%). This pattern was not frequent in A2.
5. The use of teacher acceptance and use of students' ideas (3t-3t) was similar in all ETUs namely A3: 2.4%, A2: 2.3% and A1: 1.7%.
6. The frequent use of teacher questioning followed by extensive information giving (4t-5t) was recorded in class A3 (2.9%), however it was not a frequent interaction in A1 and A2.
7. The teacher frequently gave verbal directions (6t-6t) in A2 (2.0%) and A1 (1.9%) the practice-based classes. This interaction was not frequent in the class-based lesson.
8. The student non-verbal interpretative behaviour (18\s-18\s), referring to instances when the students were actively motor/cognitive engaged ranked highest of all student behaviour interaction patterns in all three ETUs, with the highest amount of engagement time in A1 (12.2%), followed by A2 (8.4%) and A3 (8.1%).
9. The student non-verbal predictable response (18s-18s) where students were getting organised for activities was a frequent interaction pattern in A1 (7.0%) and A2 (7.0%). This pattern was not frequent in A3 the class-based session.
10. Time spent by the teacher in silence waiting for the class to turn up (20t-20t) was frequent in A2 (9.3%) and A3 (3.1).

#### 4.2.1.3 CAFIAS parameters: athletics

The CAFIAS parameters (ratios and percentages) in table 4.3 refer to teacher and student behaviours in the athletics ETUs. The table provides a title description and the abbreviation (Abb.) of the parameters and the calculations of each parameter for the athletics ETUs: A1, A2, and A3. A comparison across the three ETUs of athletics will indicate any similarities and differences across the experimental teaching conditions. These calculations were derived from the formulae available in the CAFIAS manual (Cheffers *et al.*, 1980, pg. 40-47), which have been also placed in appendix 3.17. It must be observed that the major parameters of CAFIAS (Cheffers *et al.*, 1980, pg. 75) have been organised and numbered slightly differently from the entire list of parameters (Cheffers *et al.*, 1980, pg. 40-47) and to make referral to the CAFIAS formulae easier, both references are provided in the first two columns.

Table 4.3: CAFIAS parameters for the experimental teaching units in athletics

CAFIAS parameters: Pg. 40-47	Major parameters: Pg. 75	Description of parameter	Abb.	A1	A2	A3
1.	1	Teacher Contribution, Verbal	TCV	57.06%	52.55%	75.75%
2.	2	Teacher Contribution, Non-verbal	TCNV	11.72%	12.80%	3.39%
3.	3	Total Teacher Contribution	TTC	68.79%	65.35%	79.14%
4.	4	Student Contribution, Verbal	SCV	2.30%	0.96%	6.29%
5.	5	Student Contribution, Non-verbal	SCNV	28.36%	23.79%	10.94%
6.	6	Total Student Contribution	TSC	30.66%	24.75%	17.23%
7.	7	Silence	S	0.37%	9.58%	3.46%
8.	8	Confusion	C	0.18%	0.48%	0.19%
9.	9	Total Silence / Confusion	TSC	0.55%	10.06%	3.65%
10.	18	Teacher Use of Questioning, Verbal	TQRV	0.02	0.02	0.09
11.	19	Teacher Use of Questioning, Non-verbal	TQRNV	-	0.02	0.01
12.	20	Total Teacher Use of Questioning	TTQR	0.02	0.02	0.09
13.	21	Teacher Use of Acceptance and Praise, Verbal	TAPRV	0.42	0.37	0.67
14.	22	Teacher Use of Acceptance and Praise, Non-verbal	TAPRNV	0.45	0.60	0.95
15.	23	Total Teacher Use of Acceptance and Praise	TTAPR	0.43	0.44	0.68
22.		Total Student Verbal Dependent	TSVDR	18%	34%	90%
23.		Total Student Non-verbal Dependent	TSNVDR	100%	100%	99%
24.		Total Student Dependant	TSDR	94%	97%	96%
25.	24	Student Verbal Initiation, Teacher Suggested	SVITSR	0.98	0.98	0.90
26.	25	Student Non Verbal Initiation, Teacher Suggested	SNVITSR	0.01	0.01	0.00
27.	26	Total Student Initiation, Teacher Suggested	TSITSR	0.63	0.54	0.93
28.	27	Student Verbal Initiation, Student Suggested	SVISSR	0.82	0.66	0.10
29.	28	Student Non-verbal Initiation, Student Suggested	SNVISSR	-	-	0.01
30.	29	Total Student Initiation, Student Suggested	TSISSR	0.06	0.03	0.04
31.	30	Content Emphasis – Teacher Input	CETI	0.65	0.59	0.82
32.	31	Content Emphasis- Student Input	CESI	.18	.13	.15
33.	10	Teacher As Teacher	TT	68%	69%	68%
34.	11	Other Students As Teachers	ST	32%	26%	16%

CAFIAS parameters: <i>Pg. 40-47</i>	Major parameters: <i>Pg. 75</i>	Description of parameter	Abb.	A1	A2	A3
35.	12	The Environment As Teacher	ET	1%	6%	16%
36.	13	Verbal Emphasis	VE	59.4%	53.4%	82%
37.	14	Non-verbal Emphasis	NVE	40.1%	36.6%	14.3%

In the ensuing discussion, reference will be made to the parameter numbers appearing in column one.

*Parameters 1-3: Teachers*

Teacher Contribution: Verbal (TCV) was highest in A3 (75.75%), the class-based ETU, while Teacher Contribution Non-verbal (TCNV) was similar and higher in the practice-based ETUs namely, A2 (12.80%) and A1 (11.72%), which involved demonstrations of techniques, tactics and rules by the teacher. The Total Teacher Contribution (TTC) was highest in A3 (79.14%), and it was similar in A1 (68.79%) and A2 (65.35%).

*Parameters 4-6; Students*

Student Contribution: Verbal (SCV) was highest in A3 (6.29%), the class-based ETU, while Student Contribution Non-verbal (SCNV) was similar and higher in the practice-based ETUs A1 (28.36) and A2 (23.79%), than in A3 (10.94%). The Total Student Contribution (TSC) was highest in A1 (30.66%), lower in A2 (24.75%) and least in A3 (17.23%).

*Parameters 7-9: Silence and confusion*

The Total Silence/Confusion (TSC) was highest in A2 (10.06%) and lower in A3 (3.65%) and A1 (0.55%). This accounted mainly for the time taken for the students to go to class and get settled at the beginning and the end of each lesson.

*Parameters 10-12: Teacher use of questioning*

Total Teacher use of Questioning (TTQR), comparing the questioning with information giving/lecturing behaviours was highest in A3 (0.09%) the class-based session, with negligible use of questioning in relation to teacher information giving in A1 and A2, the practice-based sessions.

*Parameters 13-15: Teacher use of acceptance and praise*

The Total Teacher Use of Acceptance and Praise (TTAPR), which compares the teachers' acceptance, praise, encouragement and empathy with the use of direction and criticism was evident in all experimental teaching conditions A3 (0.68), A2 (0.44) and A1 (0.43). These ratios indicated a balance between the amount of praise and acceptance occurring during the lesson

in relation to giving directions. There was a higher ratio in favour of acceptance, praise and encouragement in A3 and this can be explained because less time was spent on giving directions in the class-based session.

*Parameters 22-24: Student dependent*

Total Student Verbal Dependent (TSVDR), which compares verbal predictable and interpretative student responses to the total student verbal behaviours was much higher in A3 (90%), the class-based session in relation to the practice based sessions A2 (34%) and A1 (18%). In contrast, Total Student Non Verbal Dependence (TSNVDR), comparing non-verbal and predictive student responses to the total student behaviours was higher in the practice-based classes A1 (100%) and A2 (100%) closely followed by A3 (99%), the class-based sessions. Total Student Dependence (TSDR) which compares students' verbal and non-verbal predictive and interpretative behaviours to total students' behaviour was similar across the three ETUs: A2 (97%), A3 (96.00%) and A1 (94.00%).

*Parameters 25-27: Student initiation, teacher suggested*

Student Verbal Initiation (SVITSR) was highest for A1 (0.98) and A2 (0.98) and slightly lower for A3 (0.90). The Total Student Initiation, (TSITSR) which compares all student evaluative responses and initiation behaviours to the total student behaviours was highest for A3 (0.93), closely followed by A1 (0.63) and A2 (0.54). These ratios indicate the balance between the amount of evaluative and initiated verbal and non-verbal student response occurring during the lesson in relation to the total student behaviours. There was a higher ratio in favour of evaluative and initiated behaviours in A3 and this can be explained because much less time was spent on students following directions and getting organised for group activities in the class-based session.

*Parameters 28-30: Student initiation, student suggested*

The Total Student Initiation (TSISR) was low for all experimental teaching conditions with the highest ratio observed in A1 (0.06) closely followed by A3 (0.04) and A2 (0.03).

*Parameters 31-32: Content emphasis*

Content Emphasis: Teacher Input (CETI), which compares the total class time the teacher devotes to content through questioning and information given with the total amount of class time was highest in A3 (0.82) followed by A1 (0.65) and A2 (0.59). The content emphasis Student Input (CESI), which compares student interpretative behaviour with the total class time was similar across the three experimental teaching conditions A1 (0.18), A3 (0.15) and A2 (0.15). The ratios of CESI were lower than in CETI, as the teacher delivered most content.

*Parameters 33-35: Teaching agent*

The teacher as teaching agent (TT) was very similar across the three experimental teaching conditions A2 (69%), A1 (68%) and A3 (68%). Students as teaching agents, mainly through assisting the teacher in demonstrations were higher in A1 (32%) and A2 (26%), the practice-based classes in relation to A3 (16%). The environment as a teaching agent was high in A3 (16%), where video clips, handouts and charts were regularly used during the sessions. The environment was lower in A2 (6%), where only handouts were used and negligible in A1 (1%) where the sprints starting blocks were used as a teaching agent during an analytic activity during one of the sessions.

*Parameters 36-37: Verbal and non-verbal emphasis*

Verbal Emphasis (VE), including teacher and student verbal behaviours was predominant in the class-based ETU A3 (82%). Verbal behaviours were also used in the practice-based sessions A1 (59.4%) and A2 (53.4%). Non-verbal Emphasis (NVE), as expected was prevalent in the practice-based classes, where demonstrations of activities were more popular: A1 (40.1%) and A2 (36.6%). In A3 the use of non-verbal behaviours was low (14.3%).

**4.2.2 Experimental Teaching Units: Netball**

The three ETUs in netball comprised five hours of contact teaching time. The experimental teaching conditions will be referred to as N1, N2 and N3 in the following discussions representing the following ETUs:

**N1:** Physical Education: Netball (practice-based sessions); ETU 1

**N2:** Physical Education Coursework Netball: (practice-based sessions and handout); ETU 2, and

**N3:** Sport Studies Netball: (class-based sessions); ETU 3.

There were four classes that underwent the netball ETUs. Two classes for N1 and one class each for N2 and N3. The classes comprised co-educational 16-year-old first year students at post-secondary educational institutions. The classes' average attendance of students for each of the netball ETUs was as follows: N1-class 1: 11 students; N1- class 2: 10 students; N2-class 1: 15 students; and N3: 17 students.

Although all these four ETUs were recorded only the entire sessions of one class from each ETU was used for recording observations using CAFIAS analysis. The criterion used for selecting the classes for the purpose of CAFIAS analysis was to observe the same class for each ETU. Since there were no recording problems with N1, it was decided to select the

sessions held in a different school in order to reduce the bias of the sample. There was only a minor technical recording failure due to a brief electrical fault during the beginning of a lesson of N2. Since N1-class 2 and N2 were scheduled and delivered during the same morning in the same school, and the content was exactly the same with the exception of the handout at the end of N2, it was decided to use the first part of the filming of the lesson of N1-Class 2 for the purpose of CAFIAS analysis.

#### 4.2.2.1 CAFIAS categories: netball

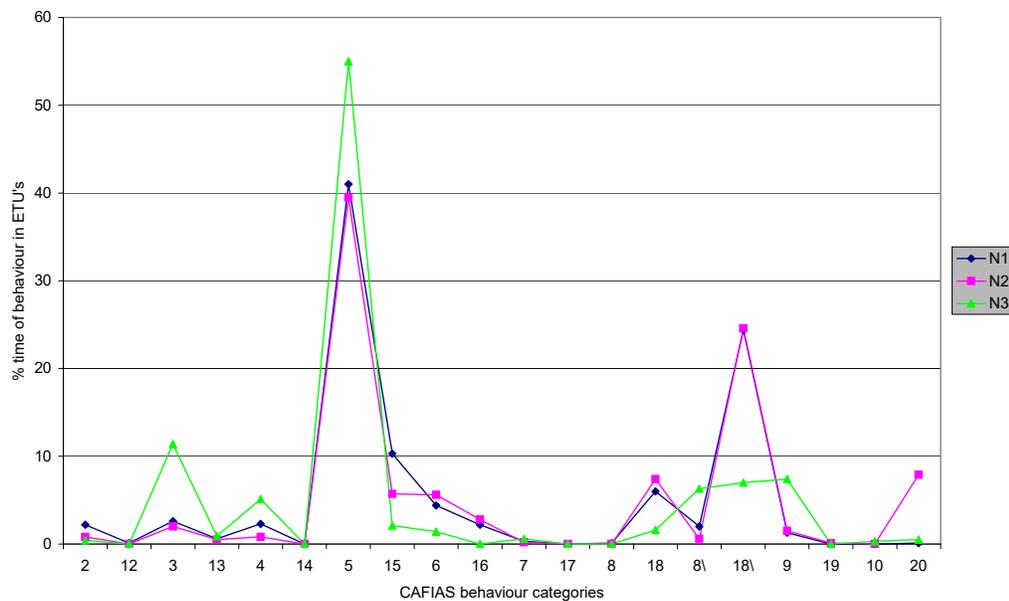
The teacher and student behaviours correspond to categories 2-20 in table 4. 4. The table includes details of the category descriptions and the recorded observations (*N*). It also gives the percentage of each category in relation to total class time for each of the three ETUs; N1, N2 and N3.

Table 4.4: CAFIAS categories of the experimental teaching conditions in netball.

Category	Categories descriptions	N1		N2		N3	
		<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
	<b><i>Teacher Behaviours</i></b>						
2	Praises or Encourages - Verbal	104	2,24	35	0,75	13	0,37
12	Praises or Encourages - Non-verbal	5	0,11	1	0,02	1	0,03
3	Accepts or Uses Ideas of Students – Verbal	119	2,56	95	2,04	402	11,38
13	Accepts or Uses Ideas of Students – Non-verbal	29	0,62	23	0,49	31	0,88
4	Asks Questions – Verbal	107	2,31	37	0,80	179	5,07
14	Asks Questions – Non-verbal	2	0,04	1	0,02	0	0,00
5	Gives Information – Verbal	1901	40,96	1839	39,55	1943	55,03
15	Gives Information – Non-verbal	480	10,34	264	5,68	75	2,12
6	Gives Directions – Verbal	205	4,42	261	5,61	48	1,36
16	Gives Directions – Non-verbal	103	2,22	128	2,75	0	0,00
7	Criticises or Justifies Authority – Verbal	12	0,26	7	0,15	22	0,62
17	Criticises or Justifies Authority – Non-verbal	0	0,00	0	0,00	0	0,00
	<b><i>Student Behaviours</i></b>	<b><i>N</i></b>	<b>%</b>	<b><i>N</i></b>	<b>%</b>	<b><i>N</i></b>	<b>%</b>
8	Student Predictable Response – Verbal	3	0,06	0	0,00	1	0,03
18	Student Predictable Response – Non-verbal	279	6,01	342	7,35	56	1,59
8\	Student Interpretative Behaviour – Verbal	95	2,05	30	0,65	221	6,26
18\	Student Interpretative Behaviour – Non-verbal	1133	24,41	1144	24,60	246	6,97
9	Student Initiative Behaviour – Verbal	59	1,27	72	1,55	262	7,42
19	Student Initiative Behaviour – Non-verbal	0	0,00	4	0,09	1	0,03
10	Confusion, Disorder, Noise	0	0,00	0	0,00	11	0,31
20	Silence	5	0,11	367	7,89	19	0,54
	Total	4641	100,00	4650	100,00	3531	100,00

The percentages of time that emerged for the CAFIAS behaviour categories on the three netball ETUs are also presented in diagrammatic form in figure 4.2

Figure 4.2: Percentages of time spent on CAFIAS behaviour categories for the three netball ETUs.



The teacher praised and encouraged students (categories 2-12) across all teaching conditions however there was a slightly higher amount of verbal praise in N1 (2.24%). Other teacher behaviours that were similar across the three experimental teaching conditions included the acceptance and use of student non-verbal ideas (category 13) and giving criticism (categories 7-17), the latter of which was negligible. The acceptance and use of students' verbal ideas (category 3) was higher in N3 (11.38%), the class-based session, were the sessions were more based on verbal exchange. The use of verbal questions (category 4) as expected was relatively higher in N3 (5.07%) as the class-based session lent itself to more opportunities of verbal communication. There was very little use of questioning occurring in N1 (2.31%) and N2 (0.80%). The time spent on giving verbal information and lecturing (category 5) was also higher in N3 (55.03%) in comparison to N1 (40.96%) and even less in N2 (39.55%). The demonstrations of activities categorised as giving non-verbal information (category 15) were expected to be similar in the practice-based sessions (N1 and N2), however, N1 (10.34%) was higher than N2 (5.68%). As expected N3 (2.12%), the class-based session was lower on the non-verbal methods of giving information. Giving directions (categories 6-16) as expected were higher for the practice-based classes N1 (4.42%, 2.22%) and N2 (5.61%, 2.75%).

Student behaviours were similar for student verbal predictable response (category 8). The student non-verbal predictable response (category 18) was higher for N2 (7.35%) and N1 (6.01%). This is mainly due to the nature of the practice-based sessions, where students spent more time getting

organised for practices than in the class-based session N3 (1.59%) where students get organised for classwork activities. The student verbal interpretative behaviour (category 8\)) was higher for N3 (6.26%) and also evident in N1 (2.05%) and N2 (0.65%). Student non-verbal interpretative behaviour (category 18\)) as expected was higher in the practice based sessions N1 (24.41%) and N2 (24.60%) as students were engaged in practising activities. In N3 some time was also spent on non-verbal interpretative activities such as written classwork exercises (6.97%). It is worth noting again that these percentages do not represent the actual engagement time (motor and cognitive activities) of the students. There were instances when the class was working (practice and classwork activities) and the teacher went round giving feedback, encouragement and information to individual students, and in these cases, the teacher's behaviour only was recorded although the remainder of the class was actively motor engaged. In this sense CAFIAS has a limitation of not being the right measurement instrument to measure motor engagement time.

Student initiated verbal behaviour (category 9) was higher in N3 (7.42%), the class-based session and student initiated non-verbal behaviour (category 19), as expected, was very low across all experimental teaching conditions. Confusion and disorder, as expected was very low. Silence was mainly due to students taking time to come to class with N2 (7.89%) having taken most time of all. The total tallies for each experimental teaching condition indicate the recorded behaviours every three seconds (N1-4641, N2-4650, N3-3531). When changed into hours it transpires that the actual hours recorded for each teaching condition were as follows: N1: 3.87 hours; N2: 3.87 hours and N3: 2.94 hours.

#### *4.2.2.2 Frequent interactions: netball*

As stated in section 4.2.1.2, CAFIAS allows for the generation of the most frequent interaction patterns. When the 20x20 matrix is used only verbal and non-verbal behaviours are provided whereas the 60x60 matrix provides information on verbal and non-verbal behaviours and the teaching agent, namely the teacher (t), student (s) and the environment (e). The use of the 60x60 matrix was considered as a more informative means to describe interactions and was utilised to analyse the data.

The most frequent interactions of the netball experimental teaching conditions are tabulated in table 4.5. The top ten cells from the 60x60 matrix are presented in rank order and details of the number of frequencies, the percentage of each interaction from the total time of the ETU and the categories of pair behaviours representing the interactions are also given in the table.

Table 4.5: Interaction patterns of experimental teaching units in netball.

Rank	N1 N=4641	%	Categories	N2 N=4650	%	Categories	N3 N=3531	%	Categories
1	1036	22,3	5t-5t	1144	24,6	5t-5t	1186	33,6	5t-5t
2	821	17,7	18\s-18\s	858	18,5	18\s-18\s	419	11,9	5e-5e
3	306	6,6	15t-15t	351	7,5	20t-20t	222	6,3	3t-3t
4	267	5,8	5t-15t	211	4,5	18s-18s	176	5,0	18\s-18\s
5	152	3,3	15s-5t	184	4,0	15t-5t	160	4,5	9s-9s
6	148	3,2	18s-18s	160	3,4	5t-15t	104	2,9	8\s-8\s
7	140	3,0	5t-15s	131	2,8	5t-18\s	82	2,3	5t-3t
8	134	2,9	5t-18\s	128	2,8	18\s-5t	70	2,0	4t-5t
9	131	2,8	18\s-5t	112	2,4	5e-5e	63	1,8	3t-8\s
10	82	1,8	5t-18s	79	1,7	6t-5t	53	1,5	8\s-4t

In N1 (5t-5t), the extended teacher verbal information giving (22.3%) was the most frequent interaction followed by (18\s-18\s), extended student non-verbal interpretative behaviour (17.7%) where students were actively engaged interpreting teacher suggested activities such as practising netball techniques, tactics and rules in game situations. The use of (15t-15t) teacher non-verbal demonstration of activities (6.6%), and (5t-15t) the use of teacher verbal giving of information followed by non-verbal teacher demonstrations (5.8%) were patterns used to give information. Verbal explanations given by the teacher were followed by student involvement in the demonstration of activities ((5t-15s), 3.0%). Teacher verbal information giving was followed by students' interpretative behaviours ((5t-18\s), 2.9%) and student interpretative response in class activities was followed by the teacher's verbal information giving ((18\s-5t), 2.8%). Time spend on student non-verbal predictive response (18s-18s), such as following a teacher direction and getting organised in group formations for practices amounted to 3.2% of the time. Teacher information giving was followed by student predictable response ((5t-18s), 1.8%) such as getting into groups. Giving verbal or non-verbal directions by the teacher (6t /16t) and the teacher's acceptance, clarification and use of students' ideas (3t) did not emerge as high patterns of interaction in this ETU.

In N2 (5t-5t) extended teacher verbal information giving (24.6%) was the highest interaction. Student non-verbal interpretative behaviour (18\s-18\s) where students were actively engaged interpreting teacher suggested activities such as motor engagement in netball skills amounted to 18.5%. The teacher spent some time waiting in silence (20t-20t) for the class to turn up (7.5%). Time spend on student non-verbal predictive response (18s-18s), such as following a teacher direction and getting organised in group formations for practices added up to 4.5%. The use of teacher non-verbal demonstration of activities followed by extended use of verbal information giving ((15t-5t), 4.0%) and vice versa, verbal information giving followed by non-verbal teacher demonstrations ((5t-15t), 3.4%) were patterns used in these sessions to present information. Teacher verbal information giving was followed by student interpretative

response ((5t-18\s), 2.8%) and vice versa, (18\s-5t) when student interpretative participation in activities without teacher involvement was followed by the teacher's verbal information giving (2.8%). The use of the environment as a teaching agent (5e-5e) was used in these sessions (2.4%) as handouts emphasised the main skills, rules and tactics taught in each lesson. Verbal directions given by the teacher were followed with information giving (6t-5t) accounted for 1.7%. The teacher's acceptance, clarification and use of students' ideas (3t) did not emerge as a frequent pattern of interaction in this ETU.

In N3 the use of extended teacher verbal information giving (5t-5t) - (33.6%) was the highest interaction followed by 5e-5e - (11.9%), where the environment in the form of video clips and handouts was the main teaching agent. The use of questioning, followed by teacher information giving (4t-5t) was used in this ETU (2.0%). The teacher's verbal acceptance, clarification and use of students' ideas (3t-3t) totalled 6.3% and it was also the case for teacher's information giving to be followed by the teacher's acceptance and development of students' ideas ((5t-3t), 2.3%). Teacher acceptance of student ideas was followed by student verbal interpretative behaviour (3t-8\s) as the teacher entered into dialogue with the students (1.8%). Student non-verbal interpretative behaviour (18\s-18\s), where students were actively engaged interpreting teacher suggested activities such as actively engaged in thinking and writing activities for the purpose of analyses of netball techniques, rules and tactics and completing classwork written exercised amounted to 5.0%. Student verbal initiated behaviour (9s-9s) occurred as students entered into meaningful discussions on aspects of the netball game (4.5%) while student verbal analytic responses (8\s-8\s) took place when students contributed to the evaluation and analysis of aspects of the netball game during the sessions (2.9%). Extended student verbal interpretative behaviour was followed by teacher questioning (8\s-4t) showing that questioning and answering was a pattern used in this ETU (1.5%).

The comparison of the interaction patterns of the three netball ETUs can be summed up as follows:

1. The highest ranked interaction across all three ETUs was (5t-5t), extended teacher verbal information given during the session. More time was spent on information giving in N3 (33.6%) in comparison to N2 (24.6%) and N1 (22.3%).
2. The use of the environment as a teaching agent (5e-5e) was highest in N3 (11.9%) followed by N2 (2.4%). The use of the environment as a teaching agent was not frequent in N1.
3. The use of non-verbal demonstration of activities (15t-15t) was frequent in N1 (6.6%) and so was the involvement of students in the demonstration of activities together with the teacher (N1 (15s-15t), 3.3%), and teacher information giving followed by demonstration

by the students N1 ((5t-15s), 3.00%). These patterns were not frequent in N2, where the teacher was demonstrating and giving information ((15t-5t), 4.0%; (5t-15t), 3.4%). The use of teacher non-verbal demonstration of activities (15t) was not a regular pattern in N3 as most demonstrations were presented through video clips.

4. The frequent use of teacher questioning followed by extensive information giving (4t-5t) was recorded as a pattern in class N3 (2.0%) only.
5. The use of teacher acceptance and use of students' ideas (3t-3t) was also observed as a frequent pattern in N3 (6.3%) only.
6. The teacher verbal and non-verbal giving of directions (6t/16t) was not a frequent interaction pattern in N1 or N3 but it was used in N2 (6t-5t), where the giving of directions was followed by teacher information giving (1.7%).
7. The student verbal interpretative behaviour ((8\s-8\s), 2.90%) and student verbal initiated behaviour (9s-9s)- (4.5%) were also frequent patterns in N3, the class-based ETU.
8. The student non-verbal interpretative behaviour (18\s-18\s) ranked high in all three ETUs, with the highest amount of engagement time in N2 (18.5%), followed by N1 (17.7%) and N3 (5.0%).
9. The student non-verbal predictable response (18s-18s), where students were getting organised for activities was a frequent interaction pattern in N2 (4.5%) and N1 (3.2%). This pattern was not frequent in A3, the class-based sessions.
10. Time spent by the teacher in silence waiting for the class to turn up (20t-20t) was frequent in N2 (7.5%) only.

#### 4.2.2.3 CAFIAS parameters: netball

Table 4.6 provides the CAFIAS parameters (ratios and percentages) referring to teacher and student behaviours in the netball ETUs. The table provides a title description and the abbreviation (Abb.) of the parameters and the calculations of each parameter for the netball ETUs: N1, N2, and N3. A comparison across the three ETUs of netball will indicate any similarities and differences across the experimental teaching conditions. For the formulae of the CAFIAS parameters (Cheffers *et al.*, 1980, pg. 40-47), see appendix 3.17. As noted earlier on, the major parameters of CAFIAS (Cheffers *et al.*, 1980, pg. 75) have been organised and numbered slightly differently from the entire list of parameters (Cheffers *et al.*, 1980, pg. 40-47) and to facilitate referral to the CAFIAS formulae, both references are provided in the first two columns.

Table 4.6: CAFIAS parameters for the experimental teaching units in netball

<i>CAFIAS parameters: Pg. 40-47</i>	<i>Major parameters: Pg. 75</i>	<i>Description of parameter</i>	<i>Abb.</i>	<i>N1</i>	<i>N2</i>	<i>N3</i>
1	1	Teacher Contribution, Verbal	TCV	52.79%	48.92%	73.83%
2	2	Teacher Contribution, Non-verbal	TCNV	13.34%	8.97%	3.03%
3	3	Total Teacher Contribution	TTC	66.13%	57.89%	76.86%
4	4	Student Contribution, Verbal	SCV	3.38%	2.19%	13.71%
5	5	Student Contribution, Non-verbal	SCNV	30.42%	32.04%	8.58%
6	6	Total Student Contribution	TSC	33.81%	34.24%	22.29%
7	7	Silence	S	0.11%	7.89%	0.54%
8	8	Confusion	C	0.00%	0.00%	0.31%
9	9	Total Silence / Confusion	TSC	0.11%	7.89%	0.85%
10	18	Teacher Use of Questioning, Verbal	TQRV	0.05	0.02	0.08
11	19	Teacher Use of Questioning, Non-verbal	TQRNV	0.00	0.00	-
12	20	Total Teacher Use of Questioning	TTQR	0.04	0.02	0.08
13	21	Teacher Use of Acceptance and Praise, Verbal	TAPRV	0.51	0.33	0.86
14	22	Teacher Use of Acceptance and Praise, Non-verbal	TAPRNV	0.25	0.16	1.00
15	23	Total Teacher Use of Acceptance and Praise	TTAPR	0.45	0.28	0.86
22		Total Student Verbal Dependent	TSVDR	62%	29%	48%
23		Total Student Non-verbal Dependent	TSNVDR	100%	100%	100%
24		Total Student Dependant	TSDR	96%	95%	67%
25	24	Student Verbal Initiation, Teacher Suggested	SVITSR	0.98	1.00	1.00
26	25	Student Non Verbal Initiation, Teacher Suggested	SNVITSR	0.01	0.01	0.00
27	26	Total Student Initiation, Teacher Suggested	TSITSR	0.82	0.79	0.93
28	27	Student Verbal Initiation, Student Suggested	SVISSR	0.38	0.71	0.54
29	28	Student Non-verbal Initiation, Student Suggested	SNVISSR	-	0.00	0.00
30	29	Total Student Initiation, Student Suggested	TSISSR	0.04	0.05	0.33
31	30	Content Emphasis – Teacher Input	CETI	0.66	0.55	0.75
32	31	Content Emphasis- Student Input	CESI	0.27	0.25	0.13
33	10	Teacher As Teacher	TT	62%	61%	63%
34	11	Other Students As Teachers	ST	37%	36%	23%

<i>CAFIAS parameters: Pg. 40-47</i>	<i>Major parameters: Pg. 75</i>	<i>Description of parameter</i>	<i>Abb.</i>	<i>N1</i>	<i>N2</i>	<i>N3</i>
35.	12	The Environment As Teacher	ET	0%	3%	14%
36.	13	Verbal Emphasis	VE	56.1%	51%	87.5%
37.	14	Non-verbal Emphasis	NVE	43.8%	41%	11.6%

In the following discussion, reference will be made to the parameter numbers appearing in column one.

*Parameters 1-3: Teacher contribution*

Teacher Contribution: Verbal (TCV) was highest in N3 (73.83%), the class-based ETU, in comparison to N1 (52.79%) and N2 (48.92%). Teacher Contribution Non-verbal (TCNV) was similar and higher in the practice-based ETUs N1 (13.34%) and N2 (8.97%), which involved demonstrations of techniques, tactics and rules by the teacher. The Total Teacher Contribution (TTC) was highest in N3 (76.86%), followed by N1 (66.13%) and N2 (57.89%).

*Parameters 4-6: Students' contribution*

Student Contribution: Verbal (SCV) was highest in N3 (13.71%), the class-based ETU, while Student Contribution Non-verbal (SCNV) was similar and higher in N2 (32.04%) and N1 (30.42), the practice-based ETUs, than in N3 (8.584%). The Total Student Contribution (TSC) was highest in N2 (34.24%), closely followed by N1 (33.81%), and least in N3 (22.29%).

*Parameters 7-9: Silence and confusion*

The Total Silence/Confusion (TSC) was highest in N2 (7.89%) and low in N3 (0.85%) and N2 (0.11%). This accounted mainly for the time taken for the student to arrive for the sessions and get settled at the beginning and the end of each lesson.

*Parameters 10-12: Teacher use of questioning*

Total Teacher Use of Questioning (TTQR), comparing the questioning with information giving/lecturing behaviours was highest in N3 (0.08) the class-based session, with negligible use of questioning in relation to teacher information giving in N1 and N2, the practice-based sessions.

*Parameters 13-15: Teacher use of acceptance and praise*

The Total Teacher Use of Acceptance and Praise (TTAPR), which compares the teachers' acceptance, praise, encouragement and empathy with the use of direction and criticism was evident in all experimental teaching conditions N3 (0.86), N1 (0.45) and N2 (0.28). These ratios indicated the balance between the amount of praise and acceptance occurring during the lesson in relation to giving directions. There was a higher ratio in favour of acceptance, praise

and encouragement in N3 and this can be explained because much less time was spent on giving directions in the class-based session.

*Parameters 22-24: Student dependent*

Total Student Verbal Dependent (TSVDR), which compares verbal predictable and interpretative student responses to the total student verbal behaviours was highest in N1 (62%), the practice based session, followed by N3 (48%) and N2 (28%). Total Student Non Verbal Dependence (TSNVDR), comparing non-verbal and predictive student responses to the total student behaviours was maximum in all ETUs N1-N3: (100%). Total Student Dependence (TSDR) which compares students' verbal and non-verbal predictive and interpretative behaviours to total students behaviour was higher in the practice-based ETUs: N1 (96%) and N2 (95%) and less in N3 (67.00%).

*Parameters 25-27: Student initiation, teacher suggested*

Student Verbal Initiation (SVITSR) was highest for N2 (1.00) and N3 (1.00), closely followed by N1 (0.98). The Total Student Initiation, (TSITSR) which compares all student evaluative responses and initiation behaviours to the total student behaviours was highest for N3 (0.93), closely followed by N1 (0.82) and N2 (0.79). These ratios showed the balance between the amount of evaluative and initiated verbal and non-verbal student responses occurring during the lesson in relation to the total student behaviours. There was a higher ratio in favour of evaluative and initiated behaviours in all ETUs, with the highest ratio emerging in N3. This can be explained because much less time was spent on students following directions and getting organised for group activities in the class-based session.

*Parameters 28-30: Student initiation, student suggested*

The Total Student Initiation (TSISR) was highest in N3 (0.33), the class-based ETU with lower ratios for N2 (0.05) and N1 (0.04), the practice-based classes.

*Parameters 31-32: Content emphasis*

Content Emphasis: Teacher Input (CETI), which compares the total class time the teacher devotes to content through questioning and information giving with the total amount of class time was highest in N3 (0.75) followed by N1 (0.66) and N2 (0.55). The Content Emphasis Student Input (CESI), which compares student interpretative behaviour with the total class time was highest in the practice-based sessions N1 (0.27), and N2 (0.25) and lower in N3 (0.13), the class-based ETU. The ratios of CESI were lower than in CETI, as the teacher delivered most of the content.

*Parameters 33-35: Teaching agent*

The teacher as teaching agent (TT) was very similar across the three experimental teaching conditions N3 (63%), N1 (62%) and N2 (61%). Students as teaching agents, mainly through assisting the teacher in demonstrations were higher in N1 (37%) and N2 (36%); the practice-based classes in relation to N3 (23%). In the class-based session, however, the use of demonstrations of techniques by the students was often included in the lesson. The environment as a teaching agent was high in N3 (14%), where video clips, handouts and charts were regularly used during the sessions. The environment was lower in N2 (3%), where only handouts were used and non-existent in N1 (0%).

*Parameters 36-37: Verbal and non-verbal emphasis*

Verbal Emphasis (VE), including teacher and student verbal behaviours was predominant in the class-based ETU N3 (87.5%). Verbal behaviours were also used in the practice-based sessions N1 (56.6%) and N2 (51.0%). Non-verbal Emphasis (NVE), as expected, was prevalent in the practice-based classes, where demonstrations of activities were more popular (N1 (43.8%) and N2 (41.0%)). In N3 the use of non-verbal behaviours was low (11.6%).

**4.2.3 Experimental Teaching Units: athletics and netball**

Each of the three experimental teaching conditions in athletics and netball involved presenting the same subject content in a different teaching environment namely; A1-N1 (practice-based sessions), A2-N2 (practice-based sessions and handout), and A3-N3 (class-based sessions). The CAFIAS categories, frequent patterns of interaction and parameters will be discussed in the following section in an attempt to identify any observable similarities and differences across the experimental teaching conditions with respect to the physical activities, namely, athletics (A1, A2 and A3) and netball (N1, N2 and N3).

*4.2.3.1 CAFIAS categories: athletics and netball*

The four practice-based experimental teaching conditions (A1, N1, A2, N2) are presented in table 4.7. The CAFIAS categories (2-20) represent teacher and student verbal and non-verbal behaviours. The table presents a comparison of the observed behaviours (N) and the calculated percentage time for each behaviour for each of the practice-based ETUs.

Table 4.7: CAFIAS categories of the experimental teaching conditions one and two in athletics and netball

Category	Categories descriptions	A1		N1		A2		N2	
		N	%	N	%	N	%	N	%
	<b>Teacher Behaviours</b>								
2	Praises or Encourages - Verbal	17	0,30	104	2,24	12	0,26	35	0,75

Category	Categories descriptions	A1		N1		A2		N2	
		N	%	N	%	N	%	N	%
12	Praises or Encourages - Non-verbal	7	0,12	5	0,11	1	0,02	1	0,02
3	Accepts or Uses Ideas of Students – Verbal	226	4,03	119	2,56	161	3,50	95	2,04
13	Accepts or Uses Ideas of Students – Non-verbal	78	1,39	29	0,62	115	2,50	23	0,49
4	Asks Questions – Verbal	57	1,02	107	2,31	45	0,98	37	0,80
14	Asks Questions – Non-verbal	0	0,00	2	0,04	7	0,15	1	0,02
5	Gives Information – Verbal	2573	45,84	1901	40,96	1898	41,31	1839	39,55
15	Gives Information – Non-verbal	467	8,32	480	10,34	387	8,42	264	5,68
6	Gives Directions – Verbal	299	5,33	205	4,42	277	6,03	261	5,61
16	Gives Directions – Non-verbal	105	1,87	103	2,22	75	1,63	128	2,75
7	Criticises or Justifies Authority – Verbal	31	0,55	12	0,26	14	0,30	7	0,15
17	Criticises or Justifies Authority – Non-verbal	1	0,02	0	0,00	3	0,07	0	0,00
	<b>Student Behaviours</b>								
8	Student Predictable Response – Verbal	2	0,04	3	0,06	1	0,02	0	0,00
18	Student Predictable Response – Non-verbal	631	11,24	279	6,01	525	11,43	342	7,35
8\	Student Interpretative Behaviour – Verbal	21	0,37	95	2,05	14	0,30	30	0,65
18\	Student Interpretative Behaviour – Non-verbal	961	17,12	1133	24,41	568	12,36	1144	24,60
9	Student Initiative Behaviour – Verbal	106	1,89	59	1,27	29	0,63	72	1,55
19	Student Initiative Behaviour – Non-verbal	0	0,00	0	0,00	0	0,00	4	0,09
10	Confusion, Disorder, Noise	10	0,18	0	0,00	22	0,48	0	0,00
20	Silence	21	0,37	5	0,11	440	9,58	367	7,89
	Total	5613	100,00	4641	100,00	4594	100,00	4650	100,00

The teachers' praise and encouragement (categories 2-12) during the practice-based sessions (A1, N1, A2, N2) were similar, except for a slightly higher amount of praise and encouragement in N1 (2.24%). The acceptance or use of ideas of students (categories 3-13) was higher in athletics (A1 (4.03%, 1.39%) and A2 (3.50%, 2.50%)) in comparison to both N1 and N2 respectively. The use of questioning (categories 4-14) was low across the four ETUs. The giving of verbal information (category 5) was slightly higher for both athletics ETUs (A1 (45.84%) and A2 (41.31%)) in comparison to netball (N1 (40.96%) and N2 (39.55%)). The information given through non-verbal means (demonstrations) (category 15) was slightly higher for N1 (10.34%) in comparison to A1 (8.32%), and higher for A2 (8.42%) in comparison to N2 (5.68%). The amount of time spent on giving directions (6-16) and criticising (7-17) was similar across the four ETUs.

The student predictable verbal responses (category 8), the student initiative behaviours (9-19) and the percentage time taken to get the class together (category 10) were all similar across the four ETUs. There was more time spent on student predictable non-verbal response (category 18) in athletics (A1 (11.24%) and A2 (11.43%)) as students got organised for activities in comparison to

netball (N1 (6.01%) and N2 (7.35%)). Student predictive verbal behaviour (category 8\ ) was low with a slightly higher input from N1 (2.05%). Student predictive non-verbal behaviour (category 18\ ) was higher for both netball ETUs (N1 (24.41%) and N2 (24.60%)) in comparison to athletics (A1 (17.12%) and A2 (12.36%)). Two classes (A2: 9.58%, and N2: 7.89%) took more time to get to the sessions (category 20).

The other two experimental teaching conditions (A3, N3) were class-based and are presented in table 4.8.

Table 4.8: CAFIAS categories of the experimental teaching condition three in athletics and netball

Category	Categories descriptions	A3		N3	
		N	%	N	%
	<b>Teacher Behaviours</b>				
2	Praises or Encourages - Verbal	11	0,27	13	0,37
12	Praises or Encourages - Non-verbal	3	0,07	1	0,03
3	Accepts or Uses Ideas of Students – Verbal	255	6,17	402	11,38
13	Accepts or Uses Ideas of Students – Non-verbal	18	0,44	31	0,88
4	Asks Questions – Verbal	243	5,88	179	5,07
14	Asks Questions – Non-verbal	1	0,02	0	0,00
5	Gives Information – Verbal	2487	60,19	1943	55,03
15	Gives Information – Non-verbal	117	2,83	75	2,12
6	Gives Directions – Verbal	115	2,78	48	1,36
16	Gives Directions – Non-verbal	1	0,02	0	0,00
7	Criticises or Justifies Authority – Verbal	18	0,44	22	0,62
17	Criticises or Justifies Authority – Non-verbal	0	0,00	0	0,00
	<b>Student Behaviours</b>				
8	Student Predictable Response – Verbal	25	0,61	1	0,03
18	Student Predictable Response – Non-verbal	22	0,53	56	1,59
8\	Student Interpretative Behaviour – Verbal	210	5,08	221	6,26
18\	Student Interpretative Behaviour – Non-verbal	427	10,33	246	6,97
9	Student Initiative Behaviour – Verbal	25	0,61	262	7,42
19	Student Initiative Behaviour – Non-verbal	3	0,07	1	0,03
10	Confusion, Disorder, Noise	8	0,19	11	0,31
20	Silence	143	3,46	19	0,54
	Total	4132	100,00	3531	100,00

Teacher behaviours such as praise and encouragement (categories 2-12), the use of questions (categories 4-14), the use of teacher demonstrations (category 15), giving directions (categories 6-16) and criticism (categories 7-17) were similar for both athletics and netball class-based sessions. The acceptance or use of verbal ideas of students (category 3) was higher for netball: N3

(11.38%) in comparison to athletics A3 (6.17%). The giving of verbal information (category 5) was higher for athletics: A3 (60.19%) than for netball: N3 (55.03%).

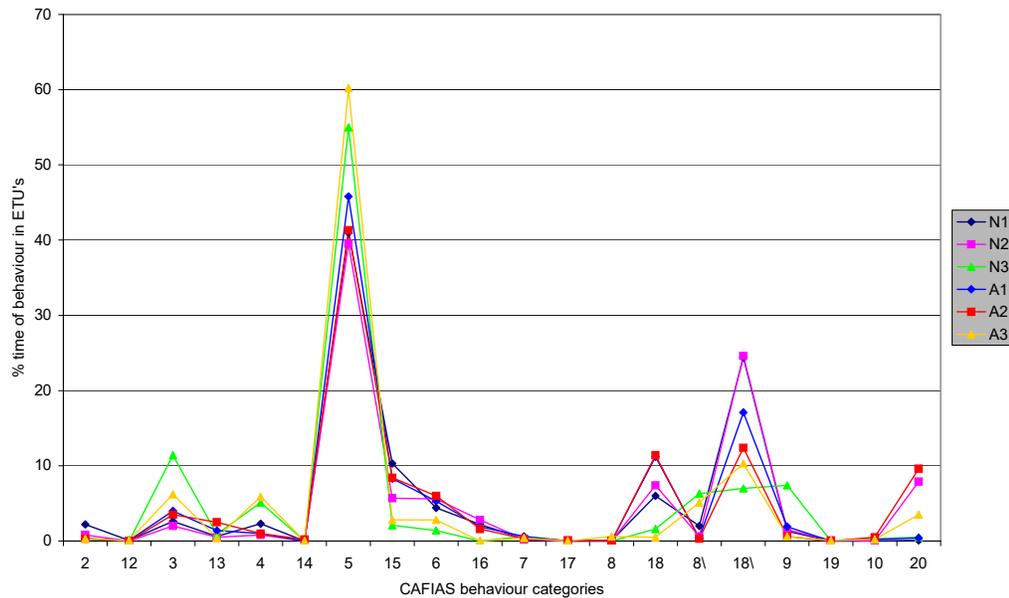
Student behaviours for the class-based athletics and netball sessions were also similar in the case of student predictable responses (categories 8-18), student interpretative behaviour (category 8\), student initiative non-verbal behaviour (category 19) and confusion related to the class getting ready (category 10). Student interpretative non-verbal behaviour (category 18\), such as writing and thinking activities in the classroom were higher for athletics A3 (10.33%) in comparison to netball N3 (6.97%). Student initiative verbal behaviour (category 9) was higher for netball N3 (7.42%) than for athletics A3 (0.61%). Athletics students took more time to get to class (category 20) A3 (3.46%) in comparison to netball students N3 (0.54%).

When the categories of the practice-based (A1, N1, A2, N2) and class-based (A3, N3) ETUs were compared (see tables 4.7 and 4.8) it was evident that teacher behaviours such as praise and encouragement (categories 2-12) and criticism (categories 7-17) were low and similar across practice and class-based ETUs. The acceptance or use of verbal ideas of students (category 3) was higher for class-based ETUs while the acceptance of non-verbal ideas was higher for practice-based ETUs. The use of questioning (category 4) and giving of verbal information (category 5) was higher for the class-based ETUs while the use of non-verbal teacher demonstrations (category 15) and the giving of directions (category 6) was higher for the practice-based classes.

Student predictable responses (category 8) were low and similar for all ETUs, however higher for A3 (0.61). Student predictive non-verbal behaviours (category 18), such as getting organised for activities was higher in the practice-based ETUs. Student verbal interpretative behaviour (category 8\), such as participating in discussions, and student initiative verbal behaviour (category 9) were higher in the class-based sessions, however the latter was more evident in the Netball class. Student non-verbal interpretative behaviour (category 18\), involving students actively engaged in motor/cognitive skills without communicating orally was higher in the practice-based ETUs. Only students in the class and handout based ETUs took more time to get to class (category 20).

The percentages of time spent on CAFIAS behaviour categories for the six ETUs are also presented in diagrammatic form in figure 4.3

Figure 4.3: Percentages of time spent on CAFIAS behaviour categories for the six ETUs: athletics and netball.



From the teacher verbal and non-verbal behaviours (categories 2 to 17) it is evident that there were similarities between the behaviour categories of praise and encouragement (categories 2-12) and giving criticism (categories 7-17) across the six ETUs. The student's verbal predictable response behaviour (category 8) and the student initiated non-verbal behaviour (categories 19) were also similar for all six ETUs.

There were some CAFIAS behaviour categories that resulted as predominant with respect to the three experimental teaching conditions namely the practice-based sessions (A1, N1), the practice-based sessions and handout (A2, N2), and the class-based sessions (A3, N3), while others were more related to the physical activity.

The following behaviours emerged as more prevalent in the class-based sessions A3 and N3;

1. the acceptance and use of students' verbal ideas (category 3);
2. the use of verbal questions (category 4);
3. the time spent on giving verbal information and lecturing (category 5); and
4. the student verbal interpretative behaviour (category 8\)

The behaviours that resulted as more popular in the practice-based ETUs (A1, N1) and the practice-based and handout ETUs (A2, N2) were:

1. the demonstrations of activities categorised as giving non-verbal information (category 15);  
and
2. the instances of giving directions (categories 6-16)

It must be observed that the behaviour categories that resulted as common to the physical activities (i.e. netball or athletics), irrespective of the three experimental teaching conditions, were student behaviours. The student non-verbal predictable response (category 18), where students were getting organised in groups for practices was much higher for the athletics practice orientated sessions (A1, A2) than for the netball practice orientated sessions (N1, N2). The percentage time spent on getting organised was much lower for the class-based sessions though (A3 and N3). The student non-verbal interpretative behaviour (category 18), where students were engaged in practising activities was evidently higher for the netball (N1, N2) than for the athletics practice orientated classes (A1, A2). In the class-based sessions the time spent on non-verbal interpretative activities (category 18) such as doing written classwork exercises was also higher for the netball class (N3) than for the athletics class (A3). Student initiated verbal behaviour (category 9) was common in the netball class-based ETU only.

The statistical significance of the differences between the CAFIAS behaviour categories in relation to the ETUs and the physical activities was calculated using adjusted residuals. This statistical measure has been selected because it gives a measure of the difference between the observed and expected values for each cell, one that is independent of the size of the expected frequencies. When the absolute value of the adjusted residual, i.e. ignoring its sign, is more than about 1.96, this suggests a lack of fit of the null hypothesis in that cell (Hutcheson and Sofroniou, 1999, pg. 167). For calculating the adjusted residuals of the CAFIAS behaviour categories, all the verbal and non-verbal categories with the exception of giving information in the form of lecturing and non-verbal demonstration (5,15) and student interpretative behaviours (8, 18), were collapsed together. From the analysis it emerged that there were statistically significant differences for all the CAFIAS behaviours between the experimental teaching conditions with the exception of student criticism (7, 17), as this was low and similar across all ETUs. The residual values of the remaining CAFIAS behaviour categories were all above 1.96 (see appendix 4.1). This was further supported by significant differences of the tests of the Pearson  $X^2$  for differences between CAFIAS behaviour categories and the experimental teaching conditions ( $X^2=4200.981$   $df=24$   $p<0.001$ ). The difference between CAFIAS behaviour categories and the physical activities (athletics and netball) were also found to be significantly different ( $X^2=536.114$ ,  $df=12$   $p<0.001$ ), and all CAFIAS behaviours except for acceptance and use of student ideas (category 3), use of questioning (category 4) and use of demonstrations for teaching (category 15) resulted in residual values above 1.96 (see appendix 4.2). Thus, the null hypotheses, that there are no significant differences between CAFIAS behaviours and physical activities and experimental teaching conditions is rejected.

#### 4.2.3.2 Frequent interactions: athletics and netball

The ETUs involved practice (A1, N1, A2, N2) and class-based (A3, N3) sessions and it is of interest to note any similarities and differences between the interaction patterns that emerged in the ETUs as a result of the impact of the experimental teaching conditions. The most frequent interaction patterns for each of the athletics and netball ETUs have already been discussed separately (see 4.2.1.2 and 4.2.2.2) and it is appropriate to further compare them. *Note that the interaction patterns for the three ETUs of each of athletics and netball are tabulated in table 4.2 (athletics) and table 4.5 (netball).*

1. The highest ranked interaction across all practice and class-based ETUs (A1, N1, A2, N2, A3, and N3) was (5t-5t); extended teacher verbal information given during the sessions.
2. The use of the environment as a teaching agent (5e-5e) was a frequent pattern of interaction in the class-based ETUs (A3, N3) only.
3. The use of non-verbal information giving by the teacher (15t) was a frequent pattern in the practice-based (A1, N1, A2, N2) classes only.
4. The use of student demonstrations (15s) was a frequent pattern in the practice-based (A1, N1, A2, and N2) sessions only.
5. The frequent use of teacher questioning followed by extensive information giving (4t-5t) was observed in the class-based (A3, N3) ETUs only.
6. The teacher's acceptance and use of students' ideas (3t-3t) was frequent and similar in all three athletics ETUs and in the Netball class-based ETU (N3) only.
7. The teacher use of giving verbal directions (6t-6t) was frequent in the practice-based (A3, N3) ETUs only.
8. The student verbal interpretative behaviour (8\s-8\s) was frequent in the class-based (A3, N3) ETUs only while the student verbal initiating behaviour (9s-9s) was frequent in the netball class-based (N3) ETU only.
9. The student non-verbal interpretative behaviour (18\s-18\s), referring to instances when the students were actively motor/cognitive engaged was frequent in all six ETUs, however it was slightly lower in the netball class-based (N3) ETU.
10. The student non-verbal predictable response (18s-18s), where students were getting organised for activities was a frequent interaction pattern in the practice-based (A1, N1, A2, N2) ETUs.
11. Time spent by the teacher in silence waiting for the class to turn up (20t-20t) was frequent in three particular ETUs, A2, A3 and N2.

These findings suggest that there were a lot of similarities between the experimental teaching condition i.e. class-based (A1, N1, A2, N2), and practice-based (A3, N3), irrespective of the physical activity, and that there were frequent interaction patterns that were predominant in particular ETUs.

#### 4.2.3.3 CAFIAS parameters: athletics and netball

CAFIAS parameters (ratios and percentages) refer to specific groups of teacher and student behaviours for each ETU and it is of relevance to consider any emerging similarities and differences across the experimental teaching conditions with respect to the two physical activities. The ETUs involved practice (A1, N1, A2, and N2) and class-based (A3, N3) sessions and the following discussion will attempt to identify parameters that have been found to be particular to all or some of the ETUs. CAFIAS parameters for each of the three athletics and netball ETUs have already been discussed separately (see 4.2.1.3 and 4.2.2.3) and it is appropriate to further compare them. Table 4.9 provides details of the parameters relevant for the following discussion.

Table 4.9: CAFIAS parameters for the experimental teaching units in athletics and netball

<i>Description of parameter</i>	<i>Abb.</i>	<b>CAFIAS ratios: Pg. 40-47</b>	<i>A1</i>	<i>N1</i>	<i>A2</i>	<i>N2</i>	<i>A3</i>	<i>N3</i>
<b><i>Teacher behaviours</i></b>								
Total Teacher Contribution	TTC	3	68.79%	66.13%	65.35%	57.89%	79.14%	76.86%
Total Teacher Use of Questioning	TTQR	12	0.02	0.04	0.02	0.02	0.09	0.08
Total Teacher Use of Acceptance and Praise	TTAPR	15	0.43	0.45	0.44	0.28	0.68	0.86
Teacher As Teacher	TT	33	68%	62%	69%	61%	68%	63%
<b><i>Student behaviours</i></b>								
Total Student Contribution	TSC	6	30.66%	33.81%	24.75%	34.24%	17.23%	22.29%
Total Student Interpretation	TSIR	21	37%	18%	46%	21%	7%	7%
Total Student Dependant	TSDR	24	94%	96%	97%	95%	96%	67%
Total Student Initiation, Student Suggested	TSISSR	30	0.06	0.04	0.03	0.05	0.04	0.33
Total Student Initiation, Teacher Suggested	TSITSR	27	0.63	0.82	0.54	0.79	0.93	0.93
<b><i>Content</i></b>								
Content Emphasis –Teacher Input	CETI	31	0.65	0.66	0.59	0.55	0.82	0.75
Content Emphasis- Student Input	CESI	32	.18	0.27	.13	0.25	.15	0.13
Other Students As Teachers	ST	34	32%	37%	26%	36%	16%	23%
The Environment As Teacher	ET	35	1%	0%	6%	3%	16%	14%
<b><i>Verbal (non) emphasis</i></b>								
Verbal Emphasis	VE	36	59.4%	56.1%	53.4%	51%	82%	87.5%
Non-verbal Emphasis	NVE	37	40.1%	43.8%	36.6%	41%	14.3%	11.6%

CAFIAS parameters referring to teacher behaviours such as Total Teacher Contribution (TTC) and Total Teacher use of Questioning (TTQR) and Total Teacher use of Acceptance and Praise (TTAPR) were higher for the class-based ETUs (A3, N3) than for the practice-based classes (A1, N1, A2, N2). The teacher as a teaching agent: Teacher as Teacher (TT) was similar across all six ETUs, however it was slightly higher in each case for all three athletics ETUs (A1, A2, and A3).

Student behaviours such as Total Student Contribution (TSC) and Total Student Interpretation (TSIR) were higher for the practice-based classes (A1, N1, A2, and N2). TSIR was higher for the

athletics ETUs (A1, A2), showing that more time was spent on student involvement (as opposed to teacher) in athletics practice-based classes. Total Student Dependant (TSDR) was high and similar across all ETUs with the exception of the class-based netball ETU (N3), implying that students in the netball class took more verbal and non-verbal initiatives (categories 9, 19: see tables 4.1 and 4.4). Consequently, the parameter Total Student Initiated, Student Suggested (TSISSR) although low in nature, was similar across all ETUs with the exception of the class-based netball ETU (N3) as students took the initiative to discuss issues extending the aim of the lesson. Total Student Initiated, Teacher Suggested parameter (TSITSR), was higher for the class-based sessions (A3, N3) as students in these ETUs spent less time responding to predictable responses such as responses not requiring thinking beyond the comprehension phase (Bloom's taxonomy) (Cheffers *et al.*, 1980, pg. 23) such as following directions (categories 8, 18: see tables 4.1 and 4.4).

The Content Emphasis: Teacher Input (CETI) was higher in the class-based sessions (A3, N3), where the teacher was the predominant teaching agent, while the Content Emphasis: Student Input (CESI) was highest in the Netball practice-based ETUs (N1, N2) only. This suggests that students demonstrations were more popular in netball than in athletics. The environment as a teaching agent was higher in the class-based ETUs (A2, N3) as the teacher used video clips and handouts during the lessons.

Student as teaching agents: Other Students as Teachers (ST) was higher in the practice-based classes (A1, N1, A2, and N2) as students were involved in demonstrations of skills.

The Verbal Emphasis (VE) was highest in the class-based ETUs (A3, N3) as there was more verbal communication between the teacher and the students in class. In contrast, the Non-verbal Emphasis (NVE) was highest in the practice-based ETUs (A1, N1, A2, N2). Students in this class spent more time engaged in following directions (category 18) and being academically motor engaged (category 18\ (see tables 4.1 and 4.4).

### **4.3 Summary**

These findings show that there emerged a lot of similarities of CAFIAS behaviour categories, interactions and parameters in relation to the experimental teaching conditions i.e. class-based (A1, N1, A2, N2), and practice-based (A3, N3). The CAFIAS behaviours that emerged as more common for all the practice orientated classes were demonstrations of activities and the giving of direction. For the class-based lessons, teacher acceptance and use of students' ideas, questioning, information giving/lecturing and student verbal contribution to the session resulted as the more popular behaviours. The CAFIAS top interactions were a reflection of

the highest frequencies with extended teacher lecturing emerging as the highest interaction across all class and practice-based classes. The central role played by the teacher as a teaching agent also resulted as the most frequent parameter across all ETUs. Other parameters prevalent in the practice-based classes were related to student behaviours such as participation, meaningful interpretative engagement and the involvement in demonstrations. The parameters that resulted as more common in the class-based sessions were centred round teacher behaviours such as the teacher contribution, use of questioning and acceptance of student's ideas and praise. The content input by the teacher was highest in the class-based sessions together with the verbal emphasis. The input of content by the students emerged as most predominant in the netball practice-based sessions only.

## CHAPTER 5

### RESULTS OF THE EXPERIMENTAL MODES OF ASSESSMENT

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#### 5.1 Introduction

The findings of the second study on the experimental modes of assessment will be presented in this chapter. Quantitative analysis will include descriptive and inferential statistics on the pre-tests and post-tests and testing of the hypotheses of the athletics and netball experimental groups. The focus is on showing any differences in the scores of the content (techniques, tactics and rules) and cognitive (knowledge, application and evaluation) components of the two assessment instruments; the unseen written paper (W.P.) and the video based unseen written paper (V.P.). This will have strong implications for the teaching environment and the modes of assessing the content-cognitive domains of different physical activities offered for assessments in PE.

At the qualitative level, examples of authentic answers of the questions from the W.P. and the V.P. for athletics and netball will be discussed and differences in answers coming from the same candidates will be highlighted. The subjects' evaluations and opinions regarding the teaching conditions and the modes of assessment will be presented.

#### 5.2 Preliminary data screening

After the marking of the pre-test and post-test of the netball and athletics experimental modes of assessment was completed, the marks allocated to each question as shown on the marking sheet were entered into two SPSS data files for each of the netball and athletics experimental conditions. Only the marks of subjects who completed the four experimental assessments were included in the study. The content (techniques, tactics and rules) and cognitive (knowledge, application and evaluation) components' sub-scores, together with their combinations (technique-knowledge; technique-application; and technique-evaluation, and likewise for tactics and rules) and total scores were generated by summing up the variables representing the relevant questions. Each case included the independent variables and the marks acquired on the four assessments, two held at pre-test and the other two at post-test. A third data file, including the data of the netball and athletics files was generated using the combined file option. For a list of the variables of each data file see appendix 5.1.

The data was subjected to a screening process to check for distribution assumptions and the identification of outliers. This was necessary as the data was to be subjected to parametric tests, which require meeting the assumptions of normality of distribution and homogeneity for the analysis of the results to be meaningful. The data was also subjected to analysis for

skewness and kurtosis. Hutcheson and Sofroniou (1999) suggest the use of residuals for checking for violations of assumptions (pg. 25). Normal probability plots also known as quantile-quantile plots, or Q-Q plots, provide a graphical representation of the expected values for a normal distribution through the production of a diagonal line drawn from the lower left to upper right of the plot. If the actual distribution forms a diagonal, then it can be concluded that that particular variable is normally distributed. If the plots of the residuals (the difference between the observed and predicted values) lie close to the expected line for a normal distribution, then one does not need to examine the individual variables for normality (pg. 28). These Q-Q plots were generated for the total scores variables for both modes of assessments of the two physical activities and are presented in figure 5.1

Figure 5.1: Q-Q Normality plots for the total scores of athletics and netball.

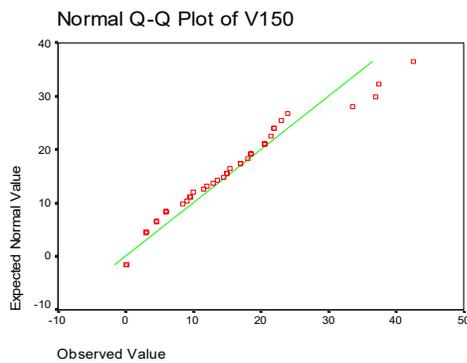


Figure 5.1a

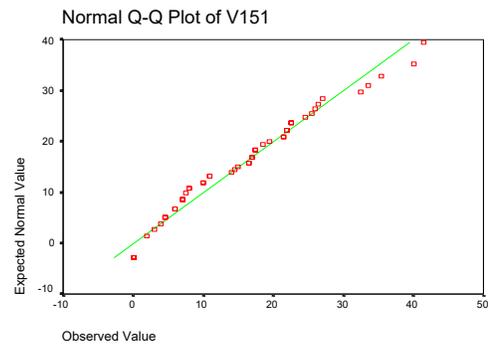


Figure 5.1b

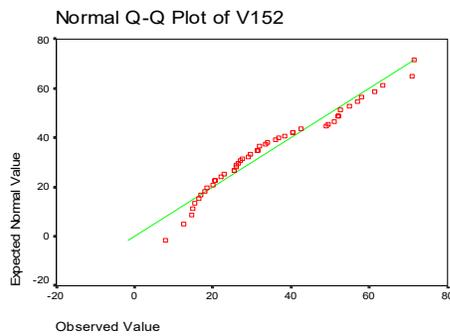


Figure 5.1c

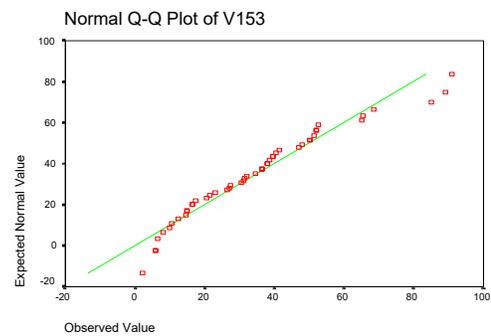


Figure 5.1d

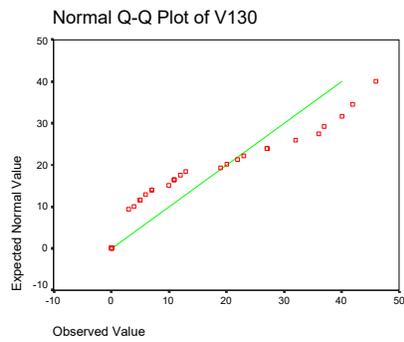


Figure 5.1e

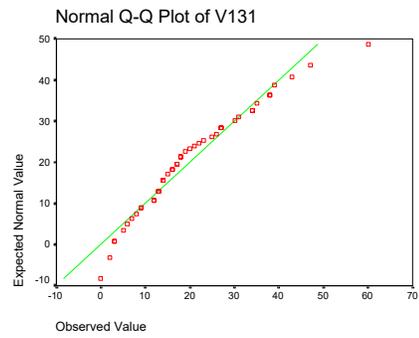


Figure 5.1f

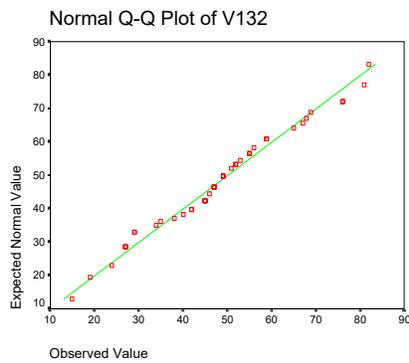


Figure 5.1g

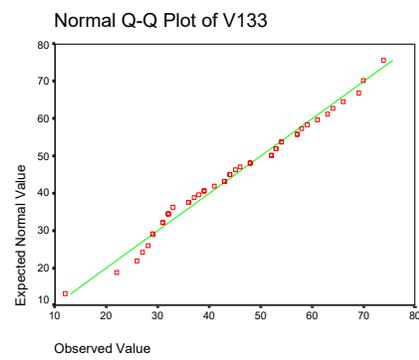


Figure 5.1h

Figures 5.1 a-d represent the total scores of the athletics assessments namely

- a) athletics; unseen written paper (W.P.) – pre-test
- b) athletics; video-based unseen written paper (V.P.) –pre-test
- c) athletics; unseen written paper (W.P.) – post-test
- d) athletics; video-based unseen written paper (V.P.) –post-test.

Figures 5.1 e-h represent the total scores of the netball assessments namely,

- e) netball; unseen written paper (W.P.) – pre-test
- f) netball; video-based unseen written paper (V.P.) –pre-test
- g) netball; unseen written paper (W.P.) – post-test
- h) netball; video-based unseen written paper (V.P.) –post-test.

From the plots it is diagrammatically evident that the data in this study can be described as Normally distributed.

### **5.3 Levels of measurement**

The raw scores obtained on the dependent variables were all interval measures, implying that they could take any value within the range of the scale. The screening of the total scores variables of the entire sample (combined file: athletics and netball and separate files: netball and athletics) on both assessment instruments (W.P. and V.P) at post- test revealed two cases as outliers in the case of the combined file on one of the assessment instruments (V.P.). These were two cases where the subjects scored higher than their counterparts (case 38: Athletics total score 91, and case 45: Athletics total score 89). The cases were not outliers in the separate data file (athletics) on the same variable (post-test V.P.) and there is diagrammatic evidence of these cases showing their relation to the normal distribution for the athletics V.P. (figure 5.1d). Unlike arbitrary scales of measurement, if the scale is meaningful, as the case of an interval scale, transformation often hinders interpretation. For example a score of '0' on any test item imply an inability on the part of the student to answer correctly that particular test item. In this situation, the cases can be retained (Tabachnick and Fidell, 1996, pg. 66). This raises the issue of data transformation procedure, which is not universally recommended as this may increase the difficulty of interpretation depending on the scale in which the variable is being measured (Tabachnick and Fidell, 1996, pg. 81-82). Transformations may be used to improve the analysis by meeting the assumptions required. Since the cases were taken from the intended population transformations of variables were not considered useful.

The statistical analysis included the use of MANOVA procedures. Thus, the mathematical requirements for MANOVA (Bryman and Cramer, 1997) were taken into consideration. These mathematical requirements are unlikely to be all met precisely and under many conditions, violating the assumptions does not necessarily invalidate the results (Bryman and Cramer, 1997). The assumptions for normality of distribution and homogeneity of variance underlie the *F*-test of significance. Although the *F*-test, like the *t*-test is remarkable robust, it is insensitive to lack of normality in the populations and to differing population variances. It is in fact unusual for any check to be made on the normality of distribution unless the departure from normality in the groups' samples is seen to be extreme.

### **5.4 Results of the modes of assessments**

The results of the pre-test and post-test scores involved the discussion of the test items with a focus on the dependant variables comprising the content and cognitive components of each of the two assessment instruments namely, the W.P. and the V.P. The generation of mean values and standard deviations were made to describe the scores while paired *t*-tests were run to measure any significant differences of the scores from pre-test to post-test for the two assessment instruments for both physical activities.

Simple factorial ANOVA was used to measure any significant differences between the two assessment instruments at post-test level for the content and cognitive domains, and the total scores. This was followed by a *post hoc* test to identify where the differences between groups lie. This attempted to show any impacts of the independent variables, namely, experimental teaching conditions, the gender of the students, attendance for the sessions, previous participation in athletics/netball and in other sport activities before the experimental treatment in relation to the modes of assessment (W.P. and V.P.) on particular content and cognitive domains.

To test the eight major hypothesis, a repeated measures five-way multiple analysis of variance (MANOVA) was used. The five independent variables (experimental teaching conditions, the gender of the students, attendance for the sessions, previous participation in athletics/netball and in other sport activities before the experimental treatment) were tested for each subject on the dependent variables (content and cognitive components and total scores). This analysis yielded results for five main effects, ten first order interactions, ten second order interactions, five third order interaction and one higher order interaction. These interactions are described in table 5.1

Table 5.1: Five-way MANOVA design

<b><i>MANOVA design</i></b>		<b><i>Main effects and interactions</i></b>
1	Experimental teaching conditions (ETU)	Main Effects
2	Gender	
3	Attendance	
4	Participating in Athletics	
5	Participating in another activity	
1	ETU x Gender	First-order interactions
2	ETU x Attendance	
3	ETU x Participating in Athletics	
4	ETU x Participating in another activity	
5	Gender x Attendance	
6	Gender x Participating in athletics	
7	Gender x Participating in another activity	
8	Attendance x Participating in athletics	
9	Attendance x Participating in another activity	
10	Participating in athletics x Participating in another activity	
1	ETU x Gender x Attendance	Second-order interactions
2	ETU x Gender x Participating in Athletics	
3	ETU x Gender x Participating in another activity	
4	ETU x Attendance x Participating in Athletic	
5	ETU x Attendance Participating in another activity	
6	ETU x Participating in Athletic x Participating in another activity	
7	Gender x Attendance x Participating in Athletic	
8	Gender x Attendance x Participating in another activity	

<i>MANOVA design</i>		<i>Main effects and interactions</i>
9	Gender x Participating in Athletic x Participating in another activity	
10	Attendance x Participating in Athletic x Participating in another activity	
1	ETU x Gender x Attendance x Participating in Athletic	Third order interactions
2	ETU x Gender x Attendance x Participating in another activity	
3	ETU x Gender x Participating in Athletic x Participating in another activity	
4	ETU x Attendance x Participating in Athletic x Participating in another activity	Third order interactions
5	Gender x Attendance x Participating in Athletic x Participating in another activity	
1	ETU x Gender x Attendance x Participating in Athletic x Participating in another activity	Higher order interactions

The measure of the main effects of the experimental teaching treatment on the two assessment instruments could be calculated and allowed for further analysis to identify the impact between the experimental teaching conditions and other independent variables on the two modes of assessment. This measure provided the answers to the following questions:

1. Which of the three teaching methods are better for teaching the content components (techniques, tactics and rules) in relation to the two modes of assessment?
2. Which of the three teaching methods are better for teaching the knowledge, application and evaluation components in relation to the two modes of assessment?

#### ***5.4.1 Athletics and Netball: Test items***

The test items used in the assessment instruments at pre-test and post-test will be discussed in an attempt to indicate the type of questions (content and cognitive domains) that resulted in being more difficult to tackle at pre-test and post-test. The use of the two assessment instruments for each of netball and athletics will also be measured for any significant differences between the video based and the written based papers at pre-test, post-test and from pre-test to post-test.

The mean values and the standard deviations of each test item (dependent variables) for the following assessment instruments at pre-test and post-test are presented in appendices 5.2 and 5.3. The tabulated results also include the range of marks allocated to each question and the content-cognitive classification of each test item.

##### Appendix 5.2

- a) Athletics W.P.: Pre-test results
- b) Athletics V.P.: Pre-test results
- c) Netball W.P.: Pre-test results
- d) Netball V.P.: Pre-test results

##### Appendix 5.3

- a) Athletics W.P.: Post-test results
- b) Athletics V.P.: Post-test results
- c) Netball W.P.: Post-test results
- d) Netball V.P.: Post-test results

An inspection of the mean values of the individual test items of the papers at pre-test revealed that for the athletics assessment instruments there were three questions in the W.P., and two questions in the V.P. that did not gain any scores. For the netball assessment instruments at pre-test all questions resulted in a score for the V.P., however for the W.P., part of two questions did not acquire any marks.

The three questions for the athletics W.P. were:

#### **W.P. (Unseen Written Paper)**

“Q 8: Figure 2 and 3 show **two** methods of baton exchange. Name the methods used in figure 2 and figure 3 (*technique/evaluation question*)”

Q9: Give **two** points of good technique for each of these methods (*technique/evaluation question*)”

Q14: Listed below are the four phases used for analysis of the shot put. Identify a common fault for each of the four phases

- a. Initial stance, grip and preparation
- b. Travel and trunk position
- c. Throwing action
- d. Release

(*technique/application question*)”

Questions 8 and 9 were linked and it is evident that the candidates had problems with identifying the techniques of methods of baton exchanges in relays. It is interesting to note that question 8 was attempted with more success in the video paper (Video Clip 5, Question 8 :V.P.), thus the active visual contributed to a difference in the quality of the answer. Question 14 also provided difficulty to the candidates in both the theory and the video papers, exposing the potential fact that the application of the shot technique, in particular faults and their corrections are not included in the athletics secondary school PE programme in Malta.

The two questions for the athletics V.P. were:

#### **V.P. (Video Based Unseen written Paper)**

“Video clip 5: Q 9

Give two points of good technique for each of these methods.  
(*technique/evaluation question*)

Video clip 8: Q14

Listed below are the four phases used for analysis of the shot put. Identify a common fault for each of the four phases

- a) Initial stance, grip and preparation
- b) Travel and trunk position
- c) Throwing action
- d) Release

(*technique/application question*)”

The question on the evaluation of the techniques of baton exchanges and the application of the shot put technique met the same faith in the V.P. It was interesting to observe that “technique-evaluation” and “technique-application” were the problematic content-cognitive areas of the athletics (power optimisation ) papers at pre-test.

For the netball pre-test assessment instruments the two questions that did not gain any scores were:

#### **W.P. (Unseen Written Paper)**

“Q7: Explain what is generally understood by the tactical term **width** in attack and how this could be used to create more scoring chances. (*tactic/application question*)

Q8: A defending player will attempt to prevent an opponent from receiving a pass. Give **FOUR** points of good defending techniques to prevent opponents from receiving a pass (*technique/application question*).”

In the case of question 7 no right answers were given for the second part of the question: i.e. how width in attack can create more scoring chances. This indicates that knowledge of application of tactics as part of the netball PE syllabus is possibly not covered to this detail in Malta. For question 8, most candidates came up with a maximum of two descriptions of application of the defending technique, showing possible lack of depth of knowledge and understanding. It is evident that the “application” cognitive component in relation to techniques and tactics has presented a common difficulty in both assessment instruments for the team game.

The mean values at post-test (see appendix 5.3) revealed that all questions gained marks for both instruments of assessments and for both physical activities (athletics and netball). The significant differences of scores for the two assessment instruments at pre-test, post-test and from pre-test to post-test will be reported for the total scores and the content-cognitive sub-scores in the following section.

#### **5.4.2 Athletics and Netball: Total scores and sub-scores**

The mean values and the standard deviations of the test-items (dependant variables) making up the content and cognitive domains (and their combinations) and the total scores for the following assessment instruments at pre-test and post-test are presented in appendices 5.4 and 5.5. The tabulated results also include the range of marks allocated to the respective content-cognitive component.

#### Appendix 5.4

- |                                     |                                   |
|-------------------------------------|-----------------------------------|
| a) Athletics W.P.: Pre-test results | c) Netball W.P.: Pre-test results |
| b) Athletics V.P.: Pre-test results | d) Netball V.P.: Pre-test results |

## Appendix 5.5

a) Athletics W.P.: Post-test results

b) Athletics V.P.: Post-test results

c) Netball W.P.: Post-test results

d) Netball V.P.: Post-test results

The mean values and standard deviations of the main content and cognitive domains for the pre-test and post-test scores of the athletics and the netball W.P. and V.P. are presented in the tables 5.2 and 5.3 respectively.

Table 5.2: Athletics: Pre-test and post-test scores for the two assessment instruments

Athletics	<i>Pre-test</i>				<i>Post-test</i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>Content</b>								
Techniques	2,57	3,73	2,94	3,66	8,26	6,83	9,58	9,02
Tactics	6,14	5,00	7,31	5,12	12,25	5,26	12,16	7,21
Rules	3,83*	4,96	5,31*	5,12	14,36	7,46	13,18	7,94
<b>Cognitive</b>								
Knowledge	6,96	5,44	7,42	5,32	13,53	7,53	13,61	8,3
Application	3,53	4,3	4,31	3,92	12,7	6,44	13,02	9,41
Evaluation	1,75	2,94	2,51	3,31	8,6	5,84	7,96	6,84
<b>Total Score</b>	12.55*	10.75	15.55*	10.86	34.86	16.32	34.98	21.70

\* Statistically significant at the  $p < 0.05$  level.

Table 5.3: Netball: Pre-test and post-test scores for the two assessment instruments

Netball	<i>Pre-test</i>				<i>Post-test</i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>Content</b>								
Techniques	3.46*	5.59	7.48*	6.48	19.52	7.58	18.08	5.86
Tactics	1.81*	4.13	5.67*	5.06	9.33	5.59	10.69	6.30
Rules	4.50*	5.95	7.10*	5.11	14.4	6.66	15.63	6.85
<b>Cognitive</b>								
Knowledge	4.02*	6.03	7.50*	7.30	16.04	6.69	17.54	6.01
Application	3.08*	4.65	8.97*	4.70	18.72*	6.67	14.27*	5.13
Evaluation	2.69*	5.22	5.35*	4.63	13.49	7.37	12.58	6.30
<b>Total Score</b>	9.79*	13.59	20.25*	12.81	48.21	15.78	44.90	14.06

\* Statistically significant at the  $p < 0.05$  level.

At pre-test level, the subjects scored higher on the total scores of the V.P. for both athletics ( $m=15.55$ ,  $S.D.=10.86$ ) and netball ( $m=20.25$ ,  $S.D.=12.81$ ) than they did on the W.P. (athletics  $m=12.55$ ,  $S.D.=10.75$ ; netball  $m=9.79$ ,  $S.D.=13.59$ ). These scores were found to be statistically significant at the two-tailed probability level (athletics:  $t = -2.199$ ,  $df=48$ ,  $p < 0.05$ ; netball:  $t = -6.412$ ,  $df=47$ ,  $p < 0.001$ ). The differences between the mean values for the two assessment

instruments for athletics at pre-test stage were also found to be statistically significant for rules ( $t=-2.224$   $df=48$   $p<0.05$ ). For the netball pre-test assessment instruments, statistically significant differences emerged between the mean values of the W.P. and the V.P. for all the content and cognitive sub-scores and their combinations at the two tailed level of  $p<0.05$  with the exception of the rules-evaluation combination ( $t=1.594$   $df=47$   $p=0.118$ ). At pre-test stage, no marks were gained in the Athletics W.P. and V.P. for the combined technique-evaluation component and for the W.P. technique-application component. In the netball W.P. and V.P. marks were recorded on each content and cognitive component.

At post-test stage, subjects scored higher on the netball W.P. ( $m=48.21$ ,  $S.D= 15.78$ ) in comparison to the V.P. ( $m=44.90$ ,  $S.D= 14.06$ ), thus reversing the situation that emerged at pre-test level, however the differences between the total scores of the netball post-test W.P. and V.P. were not found to be statistically significant ( $t=-1.777$ ,  $df=47$ ,  $p=0.082$ ). The athletics total score at post-test was higher for the V.P. ( $m=34.98$ ,  $S.D=21.70$ ), however the differences between the W.P. and the V.P. were also not found to be statistically significant ( $t=-0.067$ ,  $df=48$ ,  $p=0.947$ ). The differences between the mean values for the two assessment instruments (W.P. and V.P.) for athletics at post-test stage were found to be statistically significant for rules-evaluation ( $t=2.466$   $df=48$   $p<0.05$ ); and techniques-application ( $t=-2.341$   $df=48$   $p<0.05$ ). For the netball assessment instruments, significant differences between the mean values of the W.P. and V.P. emerged for application ( $t=3.983$   $df=47$   $p<0.001$ ), rules-knowledge ( $t=-3.841$   $df=47$   $p<0.001$ ); techniques-knowledge ( $t=0.241$   $df=47$   $p<0.001$ ) and techniques-application ( $t=2.207$   $df=47$   $p<0.05$ ).

In the case of the athletics W.P. there resulted statistically significant differences on the scores from pre-test to post-test on all the six content and cognitive sub-scores, their nine combinations and total scores at the two tailed significant level of  $p<0.05$ . The same results occurred for the V.P. with the exception of the athletics tactics-knowledge component ( $t=-0.871$   $df=48$   $p=0.388$ ). For the netball W.P. and V.P. there resulted statistically significant differences on the scores from pre-test to post-test for all the content and cognitive dependant variables and their combinations and the total scores at the two tailed significant level of  $p<0.05$ .

T-tests on the total scores, content and cognitive variables resulted in 2-tailed significant values of differences between the results from pre-test to post-test at the 0.01 on each of the two assessment instruments (W.P. and V.P.). Thus, the null hypothesis that there will be no real difference between the mean scores of the subjects from pre-test to post-test on any of the

dependent variables can therefore be rejected at the 0.01 level, and the alternative hypothesis is accepted.

When the mean values of the scores for the cognitive components were standardised to equalise the differences posed by the mark ranges allocated, it transpired that at both pre-test and post-test levels, subjects from the two physical activities scored the highest marks on knowledge, which is Bloom's first level of cognitive objectives. From table 5.4 it is also evident that subjects scored less on the application questions and even lower on the evaluation test-items for every physical activity and mode of assessment, with the exception of the netball W.P. However, the difference is negligible (0.01).

Table 5.4: Standardised scores of the cognitive components of the pre-test and post-test scores for the two assessment instruments

Cognitive Components	Range	Pre-test				Post-test			
		W.P.		V.P.		W.P.		V.P.	
		Mean	%	mean	%	mean	%	mean	%
<b><i>Athletics</i></b>									
Knowledge	0-30	6,96	<b>0,23</b>	7,42	<b>0,25</b>	13,53	<b>0,45</b>	13,61	<b>0,45</b>
Application	0-40	3,53	<b>0,09</b>	4,31	<b>0,11</b>	12,7	<b>0,32</b>	13,02	<b>0,33</b>
Evaluation	0-30	1,75	<b>0,06</b>	2,51	<b>0,08</b>	8,6	<b>0,29</b>	7,96	<b>0,27</b>
<b><i>Netball</i></b>									
Knowledge	0-30	4,02	<b>0,13</b>	7,5	<b>0,25</b>	16,04	<b>0,53</b>	17,54	<b>0,58</b>
Application	0-40	3,08	<b>0,08</b>	8,97	<b>0,22</b>	18,72	<b>0,47</b>	14,27	<b>0,36</b>
Evaluation	0-30	2,69	<b>0,09</b>	5,35	<b>0,18</b>	13,49	<b>0,45</b>	12,58	<b>0,42</b>

The remaining discussion of results for the athletics and netball modes of assessment will be presented in two separate sections, and a third section for comparing the two physical activities will follow. The discussion will focus on total scores, the content and cognitive sub-scores, and where applicable their combination.

### 5.5 Athletics: Content and cognitive results

In this section the results of the dependant variables namely, the sub-scores of the three content (techniques, tactics and rules) and the three cognitive (knowledge, application and evaluation) components, the respective content-cognitive combinations and the total scores of each of the two assessment instruments at post-test will be discussed using one way analysis of variance (ANOVA). This discussion will attempt to illustrate the main effects of the independent variables, namely, the experimental teaching condition, the gender of the students, attendance for the sessions, previous participation in athletics before the experimental treatment and previous participation in other sport activities on the different modes of assessment.

The mean scores and the standard deviations of the scores of the three ETUs of athletics at post-test for the W.P. and the V.P. are presented in table 5.5

Table 5.5: Athletics: Experimental Teaching conditions and Mean Scores and S.D of content and cognitive domains at post-test

<b>Athletics</b>	<b>ETU 1 n=12</b>				<b>ETU 2 n=25</b>				<b>ETU 3 n=12</b>			
	W.P.		V.P.		W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>Content</b>												
Techniques	8.23*	4.57	7.75*	6.45	5.28*	6.48	5.14*	4.85	14.50*	5.35	20.67*	8.94
Tactics	12.17*	6.62	13.25*	7.26	10.60*	4.44	8.36*	4.73	15.75*	5.74	19.00*	6.37
Rules	13.33*	5.01	13.67*	3.75	10.32*	5.03	7.66*	4.60	23.79*	5.23	24.21*	3.58
<b>Cognitive</b>												
Knowledge	15.67*	6.18	14.83*	7.18	9.04*	5.61	8.52*	5.87	20.75*	5.79	23.00*	4.18
Application	10.57*	5.75	12.58*	4.54	11.00*	5.94	7.50*	4.42	18.37*	4.94	24.96*	9.94
Evaluation	7.50*	4.42	7.25*	3.44	6.16*	4.93	4.24*	3.48	14.92*	4.14	16.42*	7.46
<b>Content-Cognitive</b>												
Techniques & Knowledge	6.42*	3.60	6.08*	4.42	3.12*	3.81	2.90*	3.44	8.50*	3.94	9.42*	3.50
Techniques & Application	1.32	2.27	0.50*	1.73	1.28	2.22	1.98*	2.76	1.33	2.42	6.04*	4.73
Techniques & Evaluation	0.50*	1.17	1.17*	1.95	0.88*	2.05	0.20*	0.71	4.67*	2.87	5.42*	5.14
Tactics & Knowledge	6.00*	2.26	4.92*	2.57	3.56*	2.48	2.84*	2.78	5.17*	1.90	5.58*	2.06
Tactics & Application	5.17	3.48	6.42*	3.60	6.00	3.66	4.68*	3.02	7.91	4.32	8.42*	4.29
Tactics & Evaluation	1.00	1.94	1.92*	2.31	1.04	1.81	0.84*	1.62	2.67	4.08	5.00*	4.49
Rules & Knowledge	3.25*	2.77	3.83*	2.48	2.36*	2.32	2.72*	2.28	7.08*	2.35	8.00*	1.59
Rules & Application	4.08*	2.81	4.75*	3.02	3.72*	2.60	1.74*	2.06	9.13*	2.59	8.96*	1.87
Rules & Evaluation	6.00*	2.37	5.08*	1.88	4.24*	3.02	3.20*	2.87	7.58*	2.06	7.25*	2.99
<b>Total Score</b>	33.73*	12.81	34.67*	12.25	26.20*	11.73	21.16*	11.45	54.04*	11.20	64.08*	16.18

W.P. unseen written paper; V.P. video based unseen written paper

\* Statistically significant at the  $p < 0.05$  level.

For each of the W.P. and the V.P. the differences between the mean scores of the three experimental teaching conditions were all found to be statistically significant at the 0.05 level. Significance resulted for the content and cognitive components and the total scores listed in the table 5.5 with the exception of three combined components. These were the techniques-application ( $F(2,49)=0.003, p=0.997$ )-(W.P.), tactics-application ( $F(2,49)=1.705, p=0.193$ )-(W.P.) and the tactics-evaluation (W.P.) ( $F(2,49)=1.846, p=0.169$ ). From table 5.5 it is evident that for the six content and cognitive domains and the total scores of the V.P., there emerged a consistent pattern of rank orders of the scores across the ETUs, namely, ETU 3 achieved the highest scores,

followed by ETU 1 and ETU 2. The same pattern emerged for the W.P., with the exception of the application domain, where ETU 2, scored higher than ETU 1.

Further investigation of where the differences between the groups lay revealed that for the W.P. differences emerged between ETU 3 and the other two groups (ETU 1 and ETU 2) at the 0.05 level (Scheffe Multiple Range test) for techniques, rules, evaluation and application domains. These differences (between ETU 3 and the other two groups) also resulted in the case of the following combined content-cognitive components: rules-knowledge, techniques-evaluation and rules-application. For tactics and knowledge, the significant difference emerged between ETU 3 and ETU 2. This difference also materialised for the rules-evaluation and the technique-knowledge combination. For knowledge, the difference of mean scores was also found to be significant between ETU 1 and ETU 2. Tactics-Knowledge combination was also found to be significant between ETU 1 and ETU 2. These significant levels were all at the 0.05 level (Scheffe Multiple Range test).

For the V.P. the differences of the mean values were found to be significantly different at the 0.05 level (Scheffe Multiple Range test) amongst ETUs 1 and 2, ETUs 1 and 3 and ETUs 2 and 3 for rules and knowledge. ETUs 1 and 3 and ETU 2 and 3 were found to be significantly different for techniques, evaluation and application components. Tactics were found to be significantly different between ETUs 2 and 3 only. On the V.P. the differences of the mean values were found to be significantly different amongst ETU 3 and ETUs 1 and 2 at the 0.05 level (Scheffe Multiple Range test) for the following content-cognitive combinations; rules-knowledge, rules-application, techniques-evaluation, techniques-application and tactics-evaluation. Differences also resulted between ETU 2 and 3 for rules-evaluation, tactics-knowledge, tactics-application and techniques-knowledge.

From the mean values of the total score it is evident that athletics ETUs 1 and 3 have gained higher scores on the V.P. and the differences between the score for this assessment instrument were statistically significant ( $F(2,49)=44.769, p<0.001$ ). The differences of the mean scores of the V.P. were found to be significantly different amongst ETU 1 and 2 and between ETU 3 and the other two groups at the 0.05 level (Scheffe Multiple Range test). The differences of the mean scores on the W.P. were also found to be significantly different ( $F(2,49)=22.339, p<0.001$ ). Significant differences also emerged between ETU 3 and the other two groups at the 0.05 level (Scheffe Multiple Range test).

As can be seen from table 5.5, subjects in ETU 3, the Sport Studies - athletics (class-based sessions) scored higher than the subjects in the other two groups with the exception of the

tactics-knowledge component. Here, subjects from ETU 1: Physical Education - athletics (practice-based sessions), scored higher than subjects in ETU 3.

From the evaluation of the written answers given by the subjects for the two modes of assessment (W.P. and V.P.), it was observed that some candidates answered differently for the same question. For example, a candidate from A1 (practice-based class) gave no answer to the question “Give two points of good technique for each of these two methods of baton exchange” in the case of the W.P. However, for the very same question in the V.P, this candidate scored marks for giving the correct answer. This pattern of no answer for the W.P. and a correct one for the V.P. was quite frequent in the case of the athletics modes of assessment.

The mean scores and the standard deviations for the independent variable of gender for the athletics scores at post-test for the W.P. and the V.P. are presented in table 5.6.

Table 5.6: Athletics: Gender and Mean Scores and S.D of content and cognitive domains

<i><b>ATHLETICS</b></i>	<i><b>Females N=16</b></i>				<i><b>Males n=33</b></i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i><b>Content</b></i>								
Techniques	11.28*	7.53	12.84	8.88	6.80*	6.06	8.00	8.79
Tactics	13.52	5.99	11.88	6.63	11.61	5.46	12.30	7.58
Rules	15.79	8.23	13.94	8.06	13.67	7.05	12.82	7.99
<i><b>Cognitive</b></i>								
Knowledge	16.63*	8.69	17.63*	9.02	12.03*	6.54	11.67*	7.30
Application	12.76	6.33	12.25	8.64	12.68	6.59	13.39	9.88
Evaluation	11.25*	5.95	8.75	6.36	7.36*	5.43	7.58	7.12
<i><b>Content-Cognitive</b></i>								
Techniques & Knowledge	7.06*	4.85	7.87*	4.27	4.36*	3.90	4.06*	4.15
Techniques & Application	1.53	2.62	2.66	3.86	1.19	2.05	2.59	3.72
Techniques & Evaluation	2.69	2.89	2.31	3.66	1.24	2.49	1.42	3.35
Tactics & Knowledge	4.93*	3.08	4.31	2.89	4.36*	2.17	3.88	2.80
Tactics & Application	6.12	3.83	5.19	3.14	6.33	3.91	6.42	4.01
Tactics & Evaluation	2.50	3.26	2.38	3.48	0.91	2.09	2.00	3.07
Rules & Knowledge	4.63	3.26	5.44	3.20	3.30	2.96	3.72	2.87
Rules & Application	5.10	3.97	3.69	3.95	5.15	3.26	4.51	3.64
Rules & Evaluation	6.06	2.81	4.81	3.65	5.21	3.03	4.57	2.90
<i><b>Total Score</b></i>	40.63	18.47	38.66	21.30	32.07	14.67	33.20	22.00

*W.P. unseen written paper; V.P. video based unseen written paper*

*\* Statistically significant at the  $p < 0.05$  level.*

Females have done better than their male counterparts on all six content and cognitive components of the W.P., while on the V.P., females have done better than males on techniques, rules, knowledge and evaluation. Males have done better than females on tactics and application on the V.P. Differences between groups were found to be statistically significant for techniques

on the W.P. ( $F(1,49)=5.0316, p<0.05$ ), the knowledge components of the W.P. ( $F(1,49)=4.2755, p<0.05$ ), and the V.P. ( $F(1,49)=6.1426, p<0.05$ ) and the evaluation component of the W.P. ( $F(1,49)=5.1873, p<0.05$ ).

When the content-cognitive combinations for both W.P. and V.P. were inspected it resulted that females scored higher than males on seven of the nine components for both W.P. and V.P. Males scored higher than females on both W.P. and V.P. for rules-application and tactics-application components. However the scores were found to be significantly different for three combinations namely, techniques-knowledge W.P. ( $F(1,49)=4.389 p<0.05$ ), techniques-knowledge V.P. ( $F(1,49)=8.925 p<0.005$ ) and tactics-knowledge W.P. ( $F(1,49)=4.262 p<0.05$ ). In these three cases, females scored significantly higher than males. The differences on the total scores were not found to be significantly different for neither the W.P. ( $F(1,49)=0.0925, p=0.0852$ ) nor for the V.P. ( $F(1,49)=0.6770 p=0.4148$ ).

The mean scores and the standard deviations for the athletics scores at post-test for the W.P. and the V.P. of the subjects who attended all sessions and those who missed one session are given in table 5.7.

Table 5.7: Athletics: Attendance and Mean Scores and S.D of content and cognitive domains

<b>ATHLETICS</b>	<b>Attended all sessions n=34</b>				<b>Missed one session N=15</b>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>Content</b>								
Techniques	7.42	7.16	9.07	9.94	10.17	5.79	10.73	6.65
Tactics	12.82	5.83	12.85	7.85	10.93	5.17	10.60	5.43
Rules	14.78	7.27	13.76	7.92	13.40	8.04	11.87	8.10
<b>Cognitive</b>								
Knowledge	12.35	7.36	12.44	8.20	16.20	7.50	16.27	8.19
Application	13.76	6.44	13.85	10.30	10.30	5.96	11.13	6.59
Evaluation	8.91	6.34	8.79	7.52	8.00	6.64	6.07	4.63
<b>Content-Cognitive</b>								
Techniques & Knowledge	4.32*	4.26	4.15*	4.24	7.33*	4.01	7.93*	4.13
Techniques & Application	1.39	2.42	3.24	4.04	1.10	1.80	1.20	2.48
Techniques & Evaluation	1.71	2.81	1.76	3.77	1.73	2.46	1.60	2.67
Tactics & Knowledge	4.21	2.39	3.85	2.97	5.33	2.60	4.40	2.44
Tactics & Application	6.76	3.88	6.38	4.10	3.13	3.64	5.20	2.80
Tactics & Evaluation	1.85	2.98	2.62	3.38	0.46	0.99	1.00	2.39
Rules & Knowledge	3.82	3.08	4.44	3.05	3.53	3.20	3.93	3.17
Rules & Application	5.60	3.55	4.47	3.72	4.06	3.11	3.73	3.80
Rules & Evaluation	5.35	2.81	4.85	2.96	5.80	3.36	4.20	3.54
<b>Total Score</b>	35.03	16.59	35.76	23.53	34.50	16.28	33.20	17.46

W.P. unseen written paper; V.P. video based unseen written paper \* Statistically significant at the  $p<0.05$  level.

For the W.P. and the V.P. the mean scores of the six content and cognitive components were all not found to be significantly different between the two groups at the two tailed level of 0.05. When the content-cognitive combinations for both W.P. and V.P. were examined there resulted statistically significant differences in the scores between the two groups for two combinations namely, techniques-knowledge W.P. ( $F(1,49)=5.373$   $p<0.05$ ) and V.P. ( $F(1,49)=8.417$   $p<0.01$ ). In these two cases, the group who missed one session scored significantly different and higher than the group of subjects who attended all the sessions. The non-attending group scored higher than the attending group on techniques and knowledge for both assessment instruments (W.P., V.P.). The total scores of the attending group were higher for both modes of assessment (W.P., V.P.), but not statistically significant (W.P.:  $F(1,49)=0.011$   $p=0.918$ ; V.P.:  $F(1,49)=0.143$   $p=0.707$ ). The attending subjects scored higher on all assessment items but two components.

The mean scores and the standard deviations of the subjects who participated in athletics before the experimental treatment are provided in table 5.8.

Table 5.8: Athletics: Participation in Athletics and Mean Scores and S.D of content and cognitive domains

<b>ATHLETICS</b>	<b>Participation in athletics n=6</b>				<b>Non-participation in athletics N=43</b>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>Content</b>								
Techniques	14.58*	8.67	12.17	7.08	7.38*	6.16	9.22	9.27
Tactics	13.17	5.71	13.00	5.44	12.12	5.70	12.05	7.48
Rules	17.08	7.42	14.17	9.13	13.98	7.47	13.05	7.88
<b>Cognitive</b>								
Knowledge	18.83	7.41	18.00	7.43	12.79	7.34	13.00	8.31
Application	14.00	5.92	13.83	12.54	12.52	6.55	12.91	9.08
Evaluation	12.00	7.09	9.50	5.82	8.16	5.58	7.74	7.00
<b>Content-Cognitive</b>								
Techniques & Knowledge	8.50	4.97	7.17	4.57	4.79	4.15	5.05	4.50
Techniques & Application	3.08*	3.08	1.00	2.44	1.05*	2.01	2.83	3.84
Techniques & Evaluation	3.00	3.79	4.00	4.51	1.53	2.50	1.40	3.20
Tactics & Knowledge	6.50*	2.25	6.17*	1.94	4.28*	2.42	3.72*	2.79
Tactics & Application	5.17	2.40	6.33	4.08	6.42	4.00	5.97	3.77
Tactics & Evaluation	1.50	2.51	0.50	1.22	1.42	2.66	2.35	3.30
Rules & Knowledge	3.83	3.43	4.67	3.61	3.72	3.08	4.23	3.02
Rules & Application	5.75	3.60	3.00	3.79	5.05	3.48	4.42	3.73
Rules & Evaluation	7.50	2.51	6.50	3.51	5.20	2.94	4.39	3.03
<b>Total Score</b>	44.83	17.32	39.33	20.68	33.47	15.90	34.37	22.01

W.P. unseen written paper; V.P. video based unseen written paper

\*Statistically significant at  $p<0.05$

The participants in athletics scored higher on all six content and cognitive components and the total scores for both assessment instruments (W.P., V.P.), however, when the nine content-cognitive components of the V.P. were examined, the subjects who did not participate in athletics before treatment scored higher on the rules-application, tactics-application, tactics-evaluation and techniques-application domains. Nevertheless, none of these were found to be statistically significant.

For the W.P. the mean scores of the techniques component was found to be statistically significant ( $F(1,49)=6.5284, p<0.05$ ) with the participants scoring higher than the non-participants in athletics. For the remaining content and cognitive components, three emerged statistically significant. These were: techniques-application W.P. ( $F(1,49)=4.671, p<0.05$ ), tactics-knowledge W.P. ( $F(1,49)=4.485, p<0.05$ ), and tactics-knowledge V.P. ( $F(1,49)=4.260, p<0.05$ ). In all these cases the subjects who participated in athletics scored higher than their non-participating counterparts. The total scores were not found to be significantly different for both assessment instruments (W.P.:  $F(1,49)=2.636, p=0.111$ ; V.P.:  $F(1,49)=0.271, p=0.605$ ).

The scores of the subjects who participated in physical activities other than athletics in the two years before the experimental treatment are provided in table 5.9.

Table 5.9: Athletics: Participation in other physical activities and Mean Scores & S.D of content and cognitive domains

<i><b>ATHLETICS</b></i>	<i><b>Participation in other activities n=39</b></i>				<i><b>Non-participants n=10</b></i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i><b>Content</b></i>								
Techniques	8.26	6.57	10.85	9.39	8.25	8.18	4.65	5.27
Tactics	12.62	5.82	13.31*	7.39	10.80	4.94	7.70*	4.40
Rules	15.59*	7.54	14.21	8.19	9.55*	4.96	9.20	5.55
<i><b>Cognitive</b></i>								
Knowledge	13.97	7.98	14.97*	8.22	11.80	5.43	8.30*	6.55
Application	13.04	6.65	14.20	9.89	11.40	5.67	8.40	5.42
Evaluation	9.46*	5.23	8.92*	7.11	5.40*	7.18	4.20*	4.05
<i><b>Content-Cognitive</b></i>								
Techniques & Knowledge	5.20	4.34	5.97*	4.42	5.40	4.72	2.70*	4.13
Techniques & Application	1.23	2.20	2.86	3.94	1.55	2.44	1.65	2.68
Techniques & Evaluation	1.82	2.66	2.07	3.75	1.30	2.86	0.30	0.94
Tactics & Knowledge	4.66	2.61	4.15	2.80	4.10	1.96	3.50	2.91
Tactics & Application	6.30	3.98	6.48	3.79	6.10	3.41	4.20	3.19
Tactics & Evaluation	1.64	2.74	2.66*	3.35	0.60	1.89	0.00*	0.00
Rules & Knowledge	4.10	3.17	4.85*	3.01	2.30	2.35	2.10*	2.23
Rules & Application	5.49	3.56	4.51	3.95	3.75	2.80	3.20	2.56
Rules & Evaluation	6.00*	2.64	4.85	3.05	3.50*	3.44	3.90	3.48

<i>ATHLETICS</i>	<i>Participation in other activities n=39</i>				<i>Non-participants n=10</i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>Total Score</b>	36.47	16.41	38.42	22.12	28.60	15.15	21.55	13.93

*W.P. unseen written paper; V.P. video based unseen written paper*

*\* Statistically Significant at the  $p < 0.05$*

The participants in physical activities scored higher on all content and cognitive components, their combinations and the total scores for both assessment instruments (W.P., V.P.) with the exception of the technique-knowledge (V.P.) and technique-application (V.P.) components.

For the W.P. the mean scores found to be significantly different were those of the rules ( $F(1,49)=5.7350$ ,  $p < 0.05$ ), evaluation ( $F(1,49)=4.0973$ ,  $p < 0.05$ ) and the combination rules-evaluation ( $F(1,49)=6.2177$ ,  $p < 0.05$ ). For the V.P. the mean scores of tactics ( $F(1,49)=5.2273$ ,  $p < 0.05$ ), knowledge ( $F(1,49)=5.6392$ ,  $p < 0.05$ ) and evaluation ( $F(1,49)=4.0384$ ,  $p < 0.05$ ) were found to be significantly different between the two groups. Rules and application components of the V.P. were not found to be statistically different. The following combinations were also found to be significantly different for the V.P. techniques-knowledge ( $F(1,49)=4.471$ ,  $p < 0.05$ ), tactics-evaluation ( $F(1,49)=6.206$ ,  $p = 0.05$ ) and rules-knowledge ( $F(1,49)=7.234$ ,  $p < 0.01$ ). In all these case, subjects who participated in other physical activities scored significantly higher than those who did not participate in other activities.

The total scores of those who participated in physical activities before and during treatment were found to be statistically significant for the V.P. ( $F(1,49)=5.2336$ ,  $p < 0.05$ ), with the participants scoring more than the non-participants. There emerged no significant differences for the scores of the two groups for the W.P. ( $F(1,49)= 1.884$ ,  $p = 0.176$ ).

The most popular activities practised at recreational were football, volleyball and basketball while the most cited competitive activities were football and waterpolo. Some participants practised more than one physical activity. (For a list of all the activities mentioned by the respondents see appendix 5.6).

## **5.6 Athletics: Testing of hypotheses**

The major aim of this study was to establish whether the three different experimental teaching conditions had an effect on the modes of assessing the content (techniques, tactics and rules) and cognitive (knowledge, application and evaluation) domains of athletics and netball. It is worth noting that this content-cognitive aspect of physical activities is being treated independently and as separate from other performance-based assessments aimed at measuring

motor abilities. In addition to the experimental teaching condition variable, gender, attendance for the sessions, participation in the activity (athletics), and participation in other physical activities were considered as factors that would influence the performance of students in written based assessments of PE and Sport Studies.

MANOVA analysis (repeated measures) were performed on the scores obtained by the subjects for each mode of assessment on two occasions (pre-test and post-test). This section includes the results for the athletics content (techniques, tactics and rules) and cognitive (knowledge, application and evaluation) components, and the total scores of the W.P. and V.P. Tables 5.10 and 5.11 include a summary of the statistically significant results indicating the main effects, the first, second and higher orders interactions on the dependent variables over the two testing occasions for both modes of assessment. Subsequent sections will indicate the MANOVA results and the statistically significant descriptive statistics obtained over the two testing occasions.

Table 5.10: Summary of the statistically significant MANOVA results for the athletics unseen written paper (n=49) significant at the 0.05 level

<b>Dependent Variables</b>	<b>Main Effects</b>	<b>First order interaction</b>	<b>Second order interactions</b>	<b>Higher order interactions</b>
<b><i>Content</i></b>				
Techniques	Gender	_____	_____	_____
Tactics	Attendance	_____	_____	_____
Rules	Exp. Teaching Condition.	_____	_____	_____
<b><i>Cognitive</i></b>				
Knowledge	Gender	_____	_____	_____
Evaluation	Exp. Teaching Condition. Gender. Attendance	_____	_____	_____
Application	Exp. Teaching Condition. Attendance	_____	_____	_____
<b><i>Total Score</i></b>	Exp. Teaching Condition. Gender. Attendance	_____	_____	_____

Table 5.11: Summary of the statistically significant MANOVA results for the athletics video based unseen written paper (n=49) significant at the 0.05 level

<b>Dependent Variables</b>	<b>Main Effects</b>	<b>First order interaction</b>	<b>Second order interactions</b>	<b>Higher order interactions</b>
<b><i>Content</i></b>				
Techniques	Exp. Teaching Condition.	_____	_____	_____
Tactics	Exp. Teaching Condition.	_____	_____	_____

Dependent Variables	Main Effects	First order interaction	Second order interactions	Higher order interactions
Rules	Exp. Teaching Condition.	————	————	————
<b><i>Cognitive</i></b>				
Knowledge	Exp. Teaching Condition.	————	————	————
Evaluation	Exp. Teaching Condition. Gender	————	————	————
Application	Exp. Teaching Condition	————	————	————
<b><i>Total Score</i></b>	Exp. Teaching Condition	————	————	————

The synthesis in tables 5.10 and 5.11 indicate that the null hypotheses relating to experimental teaching conditions, gender and attendance are rejected and that the alternative hypotheses are not rejected. These independent variables were found to be statistically significant on one or more of the dependent measures as main effects. The null hypotheses related to the independent variables of participating in athletics and participating in another physical activity and interactions are not rejected as these did not result in significant differences on any of the dependent variables. The alternative hypotheses for these two variables and interactions are rejected. There emerged no significant interactions of any combinations of the independent variables. The following subsections include the results and the discussion of the main effects on the dependent variables.

### ***5.6.1 Athletics Content: Techniques***

The MANOVA results for the main effects on techniques are shown in table 5.12. These indicate statistically significant main effects on gender for the W.P. and for the experimental teaching condition in the case of the V.P. Thus, the null hypothesis for the W.P. for gender is rejected and the alternative hypothesis is not rejected. For the V.P. paper the null hypothesis for experimental teaching condition is rejected and the alternative hypothesis is not rejected.

Table 5.12: MANOVA results for athletics: techniques

	TECHNIQUES	SS	d.f.	MS	F-ratio	p
	<b><i>UNSEEN WRITTEN PAPER (W.P.)</i></b>					
1	Experimental teaching conditions	51.052	2	25.256	1.228	0.306 NS
2	Gender	157.825	1	157.825	7.590	0.010
3	Attendance	40.934	1	40.934	1.969	0.170 NS
4	Participating in Athletics	2.845	1	2.845	0.137	0.714 NS
5	Participating in another activity	2.560	1	2.560	0.123	0.728 NS
	<b><i>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</i></b>					
1	Experimental teaching conditions	272.492	2	136.246	5.887	0.007
2	Gender	46.419	1	46.419	2.006	0.166 NS

	<b>TECHNIQUES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
3	Attendance	0.314	1	0.314	0.014	0.908 NS
4	Participating in Athletics	0.345	1	0.345	0.015	0.904 NS
5	Participating in another activity	1.074	1	1.074	0.046	0.831 NS

As with the pre and post-test results, there emerged a statistically significant main effect of gender on the W.P. ( $p < 0.01$ ). This can be explained by the fact that over time, females increased their score more than males on the questions of techniques. [(Occasion 1: Females  $m = 3.69$  S.D=3.74, Occasion 2  $m = 11.23$  S.D=7.53); males (Occasion 1:  $m = 2.03$ , S.D=3.66, Occasion 2  $m = 6.80$  S.D=6.06)].

For the V.P. there emerged a statistically significant main effect on the experimental teaching conditions ( $p < 0.01$ ). This is attributed to the fact that at post-test level subjects in the Sports Studies-Athletics group (ETU 3: class-based sessions) outperformed the subjects in the other two groups for the V.P. From table 5.13 it is evident that the V.P. showed up a different improvement rate for techniques for the three groups, with ETU 3 recording most improvement between pre-test and post-test.

Table 5.13: Athletics: Means and Standard Deviation scores for techniques and experimental teaching conditions.

<i>Athletics</i>	<i>ETU 1</i>	<i>ETU 2</i>	<i>ETU 3</i>
<i>Content: techniques</i>	<i>N=12</i>	<i>N=25</i>	<i>N=12</i>
<i>Video based unseen written paper (V.P.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>
Occasion 1 (pre-test)	4.00 (4.18)	1.48 (2.57)	4.92 (4.03)
Occasion 2 (post-test)	7.75 (6.45)	5.14 (4.85)	20.67 (8.94)

### 5.6.2 Athletics Content: Tactics

The null hypothesis for attendance for the tactics domain of the W.P. is rejected and the alternative hypothesis is not rejected. For the V.P. the null hypothesis for experimental teaching condition is rejected and the alternative hypothesis is not rejected. The results for the MANOVA scores are presented in table 5.14.

Table 5.14: MANOVA results for athletics: tactics

	<b>TACTICS</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<i>UNSEEN WRITTEN PAPER (W.P.)</i>					
1	Experimental teaching conditions	72.191	2	36.095	2.109	0.138 NS
2	Gender	43.410	1	43.410	2.536	0.121 NS
3	Attendance	156.436	1	156.436	9.139	0.005
4	Participating in Athletics	13.519	1	13.519	0.790	0.381 NS
5	Participating in another activity	0.425	1	0.425	0.025	0.876 NS

	<b>TACTICS</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</b>					
1	Experimental teaching conditions	210.971	2	105.485	4.685	0.016
2	Gender	11.978	1	11.978	0.532	0.471 NS
3	Attendance	8.136	1	8.136	0.361	0.552 NS
4	Participating in Athletics	12.967	1	12.967	0.576	0.453 NS
5	Participating in another activity	15.661	1	15.661	0.696	0.410 NS

Attendance emerged as a statistically significant factor for the W.P. ( $p < 0.005$ ), as the subjects who attended for the entire sessions scored higher than those who missed one session on the second occasion. (Occasion 2: Attended all session:  $m = 12.82$  S.D. = 5.83; Missed one session  $m = 10.93$  S.D. = 5.17). The experimental teaching condition emerged as a statistically significant main effect in the case of tactics for the V.P. ( $p < 0.05$ ). As can be seen in table 5.15, the practice-based Physical Education-athletics class (ETU 1) scored higher than subjects in the other two groups at pre-test level. However, subjects in the Sports Studies-Athletics group (ETU 3: class-based sessions) outperformed the subjects in the other two groups at post-test level for the V.P. The highest improvement in the scores emerged from the subjects in ETU 3: Sports Studies – athletics class.

Table 5.15: Means and Standard Deviation scores for tactics and experimental teaching conditions.

<b>Athletics</b>	<b>ETU 1</b>	<b>ETU 2</b>	<b>ETU 3</b>
<b>Content: tactics</b>	<b>N=12</b>	<b>N=25</b>	<b>N=12</b>
<b>Video based unseen written paper (V.P.)</b>	<b>M (S.D.)</b>	<b>M (S.D.)</b>	<b>M (S.D.)</b>
Occasion 1 (pre-test)	9.42 (6.63)	6.56 (4.78)	6.75 (3.77)
Occasion 2 (post-test)	13.25 (7.25)	8.36 (4.73)	19.00 (6.37)

### 5.6.3 Athletics: Content Rules

The null hypothesis for experimental teaching conditions for athletics-rules is rejected for both modes of assessment as this independent variable emerged as a statistically significant main effect as can be seen in table 5.16.

Table 5.16: MANOVA results for athletics: rules

	<b>RULES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>P</b>
	<b>UNSEEN WRITTEN PAPER (W.P.)</b>					
1	Experimental teaching conditions	577.244	2	288.622	15.855	0.000
2	Gender	39.927	1	39.927	2.193	0.148 NS
3	Attendance	47.592	1	47.592	2.614	0.116 NS
4	Participating in Athletics	6.070	1	6.070	0.333	0.568 NS
5	Participating in another activity	1.373	1	1.373	0.075	0.785 NS
	<b>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</b>					
1	Experimental teaching conditions	461.684	2	230.842	14.220	0.000

	<b>RULES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>P</b>
2	Gender	4.228	1	4.228	0.260	0.163 NS
3	Attendance	3.505	1	3.505	0.216	0.645 NS
4	Participating in Athletics	44.253	1	44.253	2.726	0.109 NS
5	Participating in another activity	1.138	1	1.138	0.070	0.793 NS

From table 5.16, it is evident that both modes of assessment were statistically significant (W.P. ( $p < 0.001$ ) and V.P. ( $p < 0.001$ )). The subjects in the Sports Studies-Athletics group (ETU 3: class-based sessions) outperformed the subjects in the other two groups. From table 5.17 it is also interesting to note that the subjects in the practice-based Physical Education-athletics class (ETU 1) scored higher than subjects in the other two groups at pre-test level for the W.P. Nevertheless, the highest improvement on the scores emerged from the subjects in ETU 3 for both modes of assessments.

Table 5.17: Athletics: Means and Standard Deviation scores for rules and experimental teaching conditions.

<i>Athletics</i>	<i>ETU 1</i>	<i>ETU 2</i>	<i>ETU 3</i>
<i>Content: rules</i>	<i>N=12</i>	<i>N=25</i>	<i>N=12</i>
<i>Unseen written paper (W.P.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>
Occasion 1 (pre-test)	7.67 (5.65)	2.04 (2.55)	3.75 (6.15)
Occasion 2 (post-test)	13.33 (5.01)	10.32 (5.03)	23.79 (5.23)
<i>Video based unseen written paper (V.P.)</i>			
Occasion 1 (pre-test)	5.67 (4.93)	4.38 (5.20)	6.87 (5.17)
Occasion 2 (post-test)	13.67 (3.75)	7.66 (4.60)	24.21 (3.58)

#### 5.6.4 Athletics Cognitive: Knowledge

The MANOVA results for the main effects on techniques are illustrated in table 5.18. These indicate statistically significant main effects on gender for the W.P. ( $p < 0.05$ ) and for the experimental teaching condition in the case of the V.P. ( $p < 0.01$ ). Therefore, the null hypothesis for the W.P. for gender is rejected and the alternative hypothesis is not rejected. For the V.P. the null hypothesis for experimental teaching condition is rejected and the alternative hypothesis is not rejected.

Table 5.18: MANOVA results for athletics: knowledge

	<b>KNOWLEDGE</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b>UNSEEN WRITTEN PAPER (W.P.)</b>					
1	Experimental teaching conditions	68.820	2	34.410	1.433	0.253 NS
2	Gender	112.927	1	112.927	4.704	0.038
3	Attendance	32.528	1	32.528	1.355	0.253 NS
4	Participating in Athletics	0.971	1	0.971	0.040	0.842 NS
5	Participating in another activity	10.817	1	10.817	0.451	0.507 NS
	<b>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</b>					
1	Experimental teaching conditions	248.023	2	124.011	6.119	0.006
2	Gender	9.676	1	9.676	0.477	0.495 NS

	<b>KNOWLEDGE</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
3	Attendance	9.112	1	9.112	0.450	0.507 NS
4	Participating in Athletics	0.323	1	0.323	0.016	0.900 NS
5	Participating in another activity	4.820	1	4.820	0.238	0.629 NS

The statistically significant main effect for gender on the W.P. ( $p < 0.05$ ) is due to the increased improvement in scores that showed up for female subjects from the first to the second testing occasion on the knowledge questions, as illustrated in table 5.19.

Table 5.19: Athletics: Means and Standard Deviation scores for knowledge and gender

<i>Athletics Cognitive: knowledge</i>	<i>Females N=16</i>	<i>Males N=33</i>
<i>Unseen written paper (W.P.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>
Occasion 1 (pre-test)	7.81 (6.40)	6.54 (4.97)
Occasion 2 (post-test)	16.63 (8.69)	12.03 (6.54)

For the V.P. there also emerged a significant main effect on the experimental teaching conditions ( $p < 0.01$ ). This is attributed to the fact that at post-test level subjects in the Sports Studies-Athletics group (ETU 3: class-based sessions) outperformed the subjects in the other two groups for the V.P., as can be seen in table 5.20.

Table 5.20: Athletics: Means and Standard Deviation scores for knowledge experimental teaching conditions.

<i>Athletics Cognitive: knowledge</i>	<i>ETU 1 N=12</i>	<i>ETU 2 N=25</i>	<i>ETU 3 N=12</i>
<i>Video based unseen written paper (V.P.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>
Occasion 1 (pre-test)	9.08 (5.96)	5.64 (4.98)	9.50 (4.36)
Occasion 2 (post-test)	14.833 (7.18)	8.52 (5.87)	23.00 (4.18)

### 5.6.5 Athletics Cognitive: Application

The null hypotheses for the experimental teaching conditions and attendance for the W.P. are rejected and the alternative hypotheses are not rejected. For the V.P. the null hypothesis for the experimental teaching condition is also rejected and the alternative hypothesis is not rejected. The MANOVA results are given in table 5.21.

Table 5.21: MANOVA results for athletics: application

	<b>APPLICATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b><i>UNSEEN WRITTEN PAPER (W.P.)</i></b>					
1	Experimental teaching conditions	278.886	2	139.443	7.295	0.002
2	Gender	11.396	1	11.396	0.596	0.446 NS
3	Attendance	113.062	1	113.062	5.915	0.021
4	Participating in Athletics	0.009	1	0.009	0.000	0.983 NS
5	Participating in another activity	0.002	1	0.002	0.000	0.992 NS
	<b><i>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</i></b>					

	<b>APPLICATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
1	Experimental teaching conditions	583.907	2	291.954	15.530	0.000
2	Gender	13.687	1	13.687	0.728	0.400 NS
3	Attendance	10.864	1	10.864	0.578	0.453 NS
4	Participating in Athletics	0.158	1	0.158	0.008	0.927 NS
5	Participating in another activity	4.560	1	4.560	0.243	0.626 NS

Both modes of assessment resulted in significant main effects on the experimental teaching conditions (W.P.  $p < 0.005$ ; V.P.  $p < 0.001$ ). The subjects in Sports Studies-Athletics group (ETU 3: class-based sessions) outperformed the subjects in the other two groups for both modes of assessments (W.P. and V.P.) on the second testing occasion, as illustrated in table 5.22.

Table 5.22: Athletics: Means and Standard Deviation scores for application and experimental teaching conditions.

<i>Athletics</i>	<i>ETU 1</i>	<i>ETU 2</i>	<i>ETU 3</i>
<i>Cognitive: Application</i>	<i>N=12</i>	<i>N=25</i>	<i>N=12</i>
<i>Unseen written paper (W.P.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>	<i>M (S.D.)</i>
Occasion 1 (pre-test)	6.67 (5.23)	2.44 (3.44)	2.66 (3.65)
Occasion 2 (post-test)	10.57 (5.75)	11.00 (5.95)	18.37 (4.94)
<i>Video based unseen written paper (V.P.)</i>			
Occasion 1 (pre-test)	5.75 (4.75)	3.46 (3.81)	4.62 (3.00)
Occasion 2 (post-test)	12.58 (4.54)	7.50 (4.42)	24.96 (9.94)

Attendance also resulted in a statistically significant main effect for the W.P. as the subjects who attended for the entire sessions, improved their score at a higher level than those who missed one session. The final scores were not significantly different though (Occasion 2: Attended all session:  $m=13.76$  S.D.=6.44; Missed one session  $m=10.30$  S.D.=5.96).

### 5.6.6 Athletics Cognitive: Evaluation

The null hypotheses for the experimental teaching conditions, gender and attendance for the W.P. are rejected and the alternative hypotheses are not rejected. For the V.P. the null hypotheses for experimental teaching condition and gender are also rejected and the alternative hypotheses are not rejected. The MANOVA results are given in table 5.23

Table 5.23: MANOVA results for athletics: evaluation

	<b>EVALUATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b><i>UNSEEN WRITTEN PAPER (W.P.)</i></b>					
1	Experimental teaching conditions	167.645	2	83.823	7.998	0.002
2	Gender	127.740	1	127.740	12.188	0.001
3	Attendance	89.638	1	89.638	8.553	0.006
4	Participating in Athletics	5.001	1	5.001	0.477	0.495 NS
5	Participating in another activity	7.405	1	7.405	0.707	0.407 NS
	<b><i>VIDEO BASED UNSEEN WRITTEN</i></b>					

	<b>EVALUATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b>PAPER (V.P.)</b>					
1	Experimental teaching conditions	250.782	2	125.391	9.000	0.001
2	Gender	50.331	1	50.331	3.613	0.066 NS
3	Attendance	4.625	1	4.625	0.332	0.568 NS
4	Participating in Athletics	27.362	1	27.362	1.964	0.171 NS
5	Participating in another activity	0.045	1	0.045	0.003	0.955 NS

The two assessment modes showed a statistically significant main effect on the experimental teaching conditions (W.P.  $p < 0.005$ ; V.P.  $p < 0.001$ ). As can be seen in table 5.24, at post-test level, subjects in the Sports Studies-Athletics group (ETU 3: class-based sessions) outperformed the subjects in the other two groups for both modes of assessments.

Table 5.24: Athletics: Means and Standard Deviation scores for evaluation and experimental teaching conditions.

<b>Athletics</b>	<b>ETU 1</b>	<b>ETU 2</b>	<b>ETU 3</b>
<b>Cognitive: Evaluation</b>	<b>N=12</b>	<b>N=25</b>	<b>N=12</b>
<b>Unseen written paper (W.P.)</b>	<b>M (S.D.)</b>	<b>M (S.D.)</b>	<b>M (S.D.)</b>
Occasion 1 (pre-test)	3.75 (3.28)	0.56 (1.42)	2.25 (3.86)
Occasion 2 (post-test)	7.50 (4.42)	6.16 (4.96)	14.92 (4.14)
<b>Video based unseen written paper (V.P.)</b>			
Occasion 1 (pre-test)	3.00 (3.86)	2.40 (3.44)	2.25 (2.60)
Occasion 2 (post-test)	7.25 (3.44)	4.24 (3.48)	16.42 (7.46)

There also resulted significant main effects for gender on the W.P. ( $p < 0.001$ ). From table 5.25 it is evident that males scored higher than females at pre-test level on the W.P. while females scored higher than males on the initial testing occasion of the V.P. However, at post-test level, females improved their score over that of males for both the W.P. and V.P.

Table 5.25: Athletics: Means and Standard Deviation scores for evaluation and gender

<b>Athletics</b>	<b>Females</b>	<b>Males</b>
<b>Cognitive: Evaluation</b>	<b>N=16</b>	<b>N=33</b>
<b>Unseen written paper (W.P.)</b>	<b>M (S.D.)</b>	<b>M (S.D.)</b>
Occasion 1 (pre-test)	1.44 (2.90)	1.91 (3.00)
Occasion 2 (post-test)	11.25 (5.95)	7.36 (5.43)
<b>Video based unseen written paper (V.P.)</b>		
Occasion 1 (pre-test)	2.62 (4.36)	2.45 (2.74)
Occasion 2 (post-test)	8.75 (6.36)	7.58 (7.12)

Attendance also showed up as a significant main effect for the cognitive component of evaluation for the W.P. ( $p < 0.01$ ). This can be explained as on the second testing occasion the scores of those who attended all the sessions were higher than that of those who missed one session. The final scores were very similar and were not significantly different (see table 5.7) (Occasion 2: Attended all session:  $m=8.911$  S.D.=6.340; Missed one session  $m=8.000$  S.D.=4.644). However, from pre-test to post-test, a higher improvement was registered for the attending group.

### 5.6.7 Athletics: Total Scores

The null hypotheses for the W.P. for the experimental teaching conditions, gender and attendance are rejected and the alternative hypothesis are not rejected. For the V.P the null hypothesis for experimental teaching condition is rejected and the alternative hypothesis is not rejected. Table 5.26 gives the results for the athletics total scores.

Table 5.26 MANOVA results for athletics: total scores

	<b>TOTAL SCORES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>P</b>
	<b><i>UNSEEN WRITTEN PAPER (W.P.)</i></b>					
1	Experimental teaching conditions	1347.711	2	673.855	7.744	0.002
2	Gender	648.733	1	648.733	7.455	0.010
3	Attendance	665.851	1	665.851	7.652	0.009
4	Participating in Athletics	19.837	1	19.837	0.228	0.636 NS
5	Participating in another activity	1.166	1	1.166	0.013	0.909 NS
	<b><i>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</i></b>					
1	Experimental teaching conditions	2785.071	2	1392.536	12.421	0.000
2	Gender	27.778	1	27.778	0.248	0.622 NS
3	Attendance	27.927	1	27.927	0.249	0.621 NS
4	Participating in Athletics	121.668	1	121.668	1.085	0.305 NS
5	Participating in another activity	15.418	1	15.418	0.138	0.713 NS

For both assessments, there emerged a significant main effect on the experimental teaching condition (W.P.  $p < 0.005$ ; V.P.  $p < 0.001$ ). Table 5.27 shows that the subjects in the practice-based Physical Education-athletics class (ETU 1) scored higher than subjects in the other two groups at pre-test level. However, at post-test level subjects in the Sports Studies-Athletics group (ETU 3: class-based sessions) outperformed the subjects in the other two groups for both modes of assessments (W.P. and V.P.).

Table 5.27: Means and Standard Deviation scores for total scores and experimental teaching conditions

<b><i>Athletics Total Scores</i></b>	<b><i>ETU 1 N=12</i></b>	<b><i>ETU 2 N=25</i></b>	<b><i>ETU 3 N=12</i></b>
<b><i>Unseen written paper (W.P.)</i></b>	<b><i>M (S.D.)</i></b>	<b><i>M (S.D.)</i></b>	<b><i>M (S.D.)</i></b>
Occasion 1 (pre-test)	19.67 (11.85)	7.60 (7.29)	15.75 (11.23)
Occasion 2 (post-test)	33.73 (12.81)	26.20 (11.73)	54.04 (11.20)
<b><i>Video based unseen written paper (V.P.)</i></b>			
Occasion 1 (pre-test)	19.08 (13.21)	12.42 (9.92)	18.54 (7.98)
Occasion 2 (post-test)	34.67 (12.25)	21.16 (11.45)	64.08 (16.18)

Gender emerged as statistically significant factor for the W.P. ( $p < 0.01$ ) as females improved their score from pre-test to post-test (Occasion 1:  $m = 12.09$  S.D=10.94, Occasion 2  $m = 40.63$  S.D=18.47) at a higher rate than males (Occasion 1:  $m = 12.77$  S.D=10.82, Occasion 2  $m = 32.07$  S.D=14.67). Attendance also showed up as a statistically significant factor for the W.P. as the

subjects who attended for the entire sessions improved their score at a higher value than those who missed one session. The final scores were very similar and were not significantly different (see table 5.7) (Occasion 2: Attended all session:  $m=35.03$  S.D.=16.59; Missed one session  $m=34.50$  S.D.=16.28).

### 5.7 Netball: Content and cognitive results

The results of the dependant variables namely the total scores, the sub-scores of the three content (techniques, tactics and rules) and the three cognitive (knowledge, application and evaluation) components will be discussed in this section using one way analysis of variance (ANOVA). Reference will also be made to the respective content-cognitive combinations of each of the two assessment instruments at post-test. The scope of the discussion is to illustrate the main effects of the independent variables, namely, the experimental teaching condition, the gender of the students, attendance for the sessions, previous participation in netball before the experimental treatment and previous participation in other sport activities, on the different modes of assessment.

The mean scores and the standard deviations of the three experimental teaching conditions of the netball scores at post-test for the W.P. and the V.P. are presented in table 5.28.

Table 5.28: Netball: Experimental Teaching conditions and Mean Scores and S.D of content and cognitive domains at post-test

<i>Netball</i>	<i>ETU 1</i> <i>n=20</i>				<i>ETU 2</i> <i>n=12</i>				<i>ETU 3</i> <i>n=16</i>			
	W.P.		V.P.		W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b><i>Content</i></b>												
Techniques	23.25*	8.18	17.50	5.61	17.92*	7.54	18.67	7.40	16.06*	4.51	18.38	5.15
Tactics	12.05*	7.08	9.60	7.33	7.33*	3.45	13.25	5.07	7.44*	2.94	10.13	5.15
Rules	16.70*	7.71	15.80	6.44	10.08*	5.05	15.25	9.21	14.75*	4.78	15.69	5.68
<b><i>Cognitive</i></b>												
Knowledge	17.30	5.61	17.30	4.61	15.17	9.54	16.83	8.74	15.13	5.49	18.38	5.38
Application	22.45*	7.03	13.35	5.56	16.58*	5.00	16.42	6.13	15.69*	5.15	13.81	3.33
Evaluation	17.00*	7.95	12.25	6.48	8.75*	5.64	13.92	7.05	12.50*	5.63	12.00	5.74
<b><i>Content-Cognitive</i></b>												
Techniques & Knowledge	7.95*	2.99	6.35	2.92	6.50*	4.03	6.67	4.01	4.62*	2.92	6.25	2.17
Techniques & Application	6.60	3.77	6.40	2.72	4.67	3.34	6.25	3.16	6.69	3.70	6.75	3.78
Techniques & Evaluation	8.70*	4.07	3.50	2.37	6.75*	3.59	4.83	3.43	4.75*	3.73	4.50	2.37
Tactics & Knowledge	4.60	3.38	7.05	2.96	3.50	3.58	5.50	4.21	5.44	3.50	7.31	2.18
Tactics & Application	4.75	3.46	3.90	3.43	5.17	3.93	4.67	2.71	5.06	2.49	4.81	3.12
Tactics &	5.00*	3.24	2.45	2.28	2.33*	2.96	4.00	3.01	1.50*	2.00	2.25	1.65

<b>Netball</b>	<b>ETU 1 n=20</b>				<b>ETU 2 n=12</b>				<b>ETU 3 n=16</b>			
	W.P.		V.P.		W.P.		V.P.		W.P.		V.P.	
Evaluation												
Rules & Knowledge	7.05	4.63	3.25	3.06	5.00	3.52	4.58	2.78	5.94	3.47	3.06	2.67
Rules & Application	5.40*	3.84	3.40	3.45	1.75*	2.00	3.67	3.68	4.31*	2.89	3.00	3.95
Rules & Evaluation	6.70	3.18	5.35	2.08	4.83	1.80	6.08	2.97	5.00	1.50	5.37	1.31
<b>Total Score</b>	56.75*	19.98	42.90	12.81	40.50*	14.85	47.17	19.04	43.31*	9.11	44.19	11.69

W.P. unseen written paper; V.P. video based unseen written paper

\*Statistically Significant Differences at the 0.05 level.

For the netball W.P. the differences between the mean scores of the six content and cognitive domains were found to be statistically significant at the 0.05 level for all dependant variables in the three experimental teaching conditions, except for knowledge ( $F(2,48)=0.596, p=0.556$ ). It was also observed that the subjects of ETU 1 (W.P.) scored highest amongst the three ETUs, for both modes of assessment. The following four content-cognitive domains emerged as significant for the W.P.: techniques-knowledge ( $F(2,48)=4.629, p<0.05$ ), techniques-application ( $F(2,48)=4.701, p<0.05$ ), tactics-evaluation ( $F(2,48)=7.570, p<0.001$ ) and rules-evaluation ( $F(2,48)=5.033, p<0.05$ ). The differences between the ETUs for the V.P. were not found to be statistically significant.

For the netball V.P., the teaching environment (ETU) also resulted in an effect on rank of the scores of the content and cognitive domains. The Physical Education Coursework group (practice-based sessions and handout), ranked top for tactics and evaluation. The Physical Education group (practice-based) ranked highest for rules and the Sport Studies Group (class-based sessions) ranked first for techniques, knowledge and application.

On investigating where the differences between the groups lay (for the W.P.), using the Scheffe Multiple Range test, there emerged differences between ETU 1 (Physical Education: Netball; the practice-based class) and ETU 2 (Physical Education Coursework Netball; the practice and handout based class) for rules (W.P.), application (W.P.), evaluation (W.P.), tactics-evaluation (W.P.), rules-evaluation (W.P.), and the total scores. Differences between ETU 1 (the practice-based class) and ETU 3 (the class-based sessions) were found to be significant for tactics (W.P.), techniques (W.P.), application (W.P.), techniques-knowledge (W.P.) techniques-application (W.P.), tactics-evaluation (W.P.) and the total scores. It was observed that differences between groups resulted solely for the W.P. and not for the V.P.

The differences between the mean scores of the three experimental teaching conditions for the V.P. were not found to be statistically significant at the 0.05 level for any of the six main content

and cognitive domains, namely, techniques ( $F(2,48)=0.172, p=0.842$ ), tactics ( $F(2,48)=1.377, p=0.263$ ), rules ( $F(2,48)=0.024, p=0.976$ ), knowledge ( $F(2,48)=0.245, p=0.783$ ), application ( $F(2,48)=1.458, p=0.243$ ) and evaluation ( $F(2,48)=0.355, p=0.703$ ). None of the differences between the scores of the ETUs for the content-cognitive combinations of the (V.P.) were found to be statistically significant at the 0.05 level.

From the mean values of the total score of the W.P. it is evident that, ETU 1 (Physical Education: Netball; the practice-based class) has gained a higher score than the other two groups and this difference was statistically significant ( $F(2,48)=0.628, p<0.005$ ). The differences between the three groups for this assessment were also significant at the 0.05 level (Scheffe Multiple Range test). The differences of the mean scores on the V.P. were not found to be significantly different ( $F(2,48)= 0.338, p=0.715$ ) for the three experimental teaching conditions.

On evaluating the written answers given by the subjects using the two modes of assessment (W.P. and V.P.), it was observed that some candidates answered differently for the same question. For example, a candidate from N1 (practice-based class) gave a very generic answer for the W.P., and a relatively technical answer for the V.P. In the W.P., the question asking for a description of “a back-up system which might be used if the player expecting a pass (at centre pass) fails to get free” (tactic-application question), the candidate wrote “a fellow player tries to get free instead, to receive the ball from the centre and then pass it to the player expecting the ball at a more appropriate time”. For the very same question in the V.P. this candidate wrote, “If for instance, the GA expects to get the ball but fails to get free, the WA and the WD try to get free to receive the ball instead”. It is observed that more technical detail related to the players, their position on court at the start play is given in the case of the answer of the video-based question. Another candidate from N3 (class-based sessions) gave four correct points for the question on the technique of the chest pass for the V.P., however, the same candidate earned less marks on the W.P. for this question as only three correct points were given.

The mean scores and the standard deviations for the independent variable of gender for the netball scores at post-test for the W.P. and the V.P. are given in table 5.29.

Table 5.29: Netball: Gender and Mean Scores and S.D of content and cognitive domains

<i>Netball</i>	<i>Females N=31</i>				<i>Males n=17</i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b><i>Content</i></b>								
Techniques	20.90	7.54	19.61*	4.79	17.00	7.19	15.29*	6.70
Tactics	10.29	5.79	10.87	6.96	7.59	4.87	10.35	5.02
Rules	16.58*	6.21	17.45*	4.76	10.41*	5.65	12.29*	8.78

<i>Netball</i>	<i>Females N=31</i>				<i>Males n=17</i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b><i>Cognitive</i></b>								
Knowledge	17.10	5.62	19.61*	4.36	14.12	8.14	13.76*	6.85
Application	20.00	6.29	14.39	4.84	16.41	6.90	14.06	5.79
Evaluation	15.81*	6.70	13.94*	6.07	9.12*	6.11	10.12*	6.13
<b><i>Content-Cognitive</i></b>								
Techniques & Knowledge	6.77	3.63	6.77	2.82	5.94	3.28	5.70	3.16
Techniques & Application	7.00	4.13	4.32	2.62	6.71	4.27	3.88	2.82
Techniques & Evaluation	7.13*	3.28	7.42*	3.09	4.35*	3.76	4.76*	2.54
Tactics & Knowledge	5.13	3.11	4.71	3.39	4.65	3.53	3.82	2.58
Tactics & Application	6.93	4.26	3.35	2.99	4.76	3.23	3.82	2.68
Tactics & Evaluation	3.35	3.38	2.81	2.48	2.82	2.85	2.71	2.23
Rules & Knowledge	5.19	3.43	8.13*	1.58	3.53	3.39	4.24*	3.68
Rules & Application	6.06	2.68	5.61	1.58	4.94	2.08	5.41	2.89
Rules & Evaluation	5.32*	3.17	3.71	3.58	1.94*	2.79	2.65	3.65
<b><i>Total Score</i></b>	52.90*	14.64	47.94*	11.19	39.65*	14.46	37.94*	16.65

*W.P. unseen written paper; V.P. video based unseen written paper*

*\*Statistically Significant Differences at the 0.05 level.*

From the results it is evident that females have done better than their male counterparts on the entire dependant variables (the six content and cognitive components, their combinations and the total scores) for the W.P. Males have done better than females on the tactics-application combination of V.P. The differences between the scores of males and females were found to be statistically significant for four dependant variables in the case of the W.P. and six dependent variables in the case of the V.P. The five dependant variables of the written paper (W.P.) were: rules ( $F(1,48)=11.525, p<0.001$ ), evaluation ( $F(1,48)=10.934, p<0.005$ ), techniques-evaluation ( $F(1,48)=7.085, p<0.05$ ) and rules-evaluation ( $F(1,48)=13.564, p<0.001$ ). The six dependant variables of the V.P. were techniques ( $F(1,48)=6.696, p<0.05$ ), rules ( $F(1,48)=7.022, p<0.05$ ), knowledge ( $F(1,48)=13.082, p<0.001$ ), evaluation ( $F(1,48)=4.311, p<0.05$ ), techniques-evaluation ( $F(1,48)=9.112, p<0.005$ ), and rules-knowledge ( $F(1,48)=26.174, p<0.001$ ).

The differences on the total scores were found to be significantly different for both the W.P. ( $F(1,48)=9.080, p<0.005$ ), and the V.P. ( $F(1,48)=6.153, p<0.05$ ), as females scored higher on both modes of assessment.

The post-test mean scores and the standard deviations for the netball W.P. and V.P. of the subjects who attended all the sessions and those who missed one session are given in table 5.30.

Table 5.30: Netball: Attendance and Mean Scores and S.D of content and cognitive domains

<i>Netball</i>	<i>Attended all sessions n=31</i>				<i>Missed one session N=17</i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b><i>Content</i></b>								
Techniques	19.16	6.99	19.00	4.95	20.18	8.76	16.41	7.08
Tactics	10.29	5.15	12.71*	6.28	7.59	6.07	7.00*	4.50
Rules	15.29	5.79	16.97	6.35	12.76	7.94	13.18	7.24
<b><i>Cognitive</i></b>								
Knowledge	17.13	7.22	19.35*	5.34	14.06	5.24	14.23*	5.88
Application	18.81	6.89	15.71	4.63	18.59	6.45	11.65	5.11
Evaluation	14.10	7.25	13.61	6.19	12.24	7.67	10.71	6.24
<b><i>Content-Cognitive</i></b>								
Techniques & Knowledge	6.55	3.64	6.74	2.88	6.35	3.33	5.76	3.07
Techniques & Application	6.45	3.52	4.64	2.68	7.71	5.09	3.29	2.51
Techniques & Evaluation	6.16	3.79	6.42	3.04	6.12	3.55	6.59	3.45
Tactics & Knowledge	5.29	3.21	5.45*	3.02	4.35	3.29	2.47*	2.34
Tactics & Application	6.51	3.99	3.84	2.82	5.53	4.15	2.94	2.97
Tactics & Evaluation	3.77	3.07	3.42*	2.43	2.06	3.17	1.59*	1.77
Rules & Knowledge	5.29	3.31	7.16	2.75	3.35	3.49	6.00	3.67
Rules & Application	5.84	2.13	6.03*	1.83	5.35	3.16	4.65*	2.34
Rules & Evaluation	4.16	3.43	3.77	3.64	4.06	3.51	2.53	3.52
<b><i>Total Score</i></b>	50.03	15.59	48.68*	13.31	44.88	16.04	36.59*	12.19

W.P. unseen written paper; V.P. video based unseen written paper

\*Statistically Significant Differences at the 0.05 level.

The scores of the subjects who attended all the sessions were higher than those of the subjects who missed one session with the exception of techniques (W.P.), techniques-evaluation (V.P.) and techniques-application (W.P.). However none of these differences were found to be statistically significant.

For the W.P. one of the six content and cognitive components or their combinations were found to be significantly different between the two groups at the two tailed level of 0.05. For the V.P. there emerged statistically significant differences for tactics ( $F(1,48)=10.930, p<0.005$ ), knowledge ( $F(1,48)=9.400, p<0.005$ ), tactics-knowledge ( $F(1,48)=12.401, p<0.001$ ), tactics-evaluation ( $F(1,48)=7.438, p<0.01$ ) and rule-application ( $F(1,48)=5.131, p<0.05$ ). In these cases, the group who attended all the sessions scored significantly different and higher than the group of subjects who missed one session.

The total score of the W.P. was not found to be statistically significant ( $F(1,48)=1.174, p=0.284$ ), however, for and the V.P. there emerged a statistically significant difference

( $F(1,48)=9.597, p<0.005$ ), as those who attended all sessions scored higher than those who missed one session.

The post-test mean scores and the standard deviations for the W.P. and the V.P. of the subjects who participated in netball before the experimental treatment are provided in table 5. 31.

Table 5.31: Netball: Participation in Netball and Mean Scores and S.D of content and cognitive domains

<b>Netball</b>	<b>Participation in netball n=18</b>				<b>Non-participation in netball N=30</b>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>Content</b>								
Techniques	17.06	5.38	19.17	5.16	21.00	8.37	17.43	6.23
Tactics	9.22	4.67	11.72	6.82	9.40	6.14	10.07	5.99
Rules	15.72	5.23	17.50	4.76	13.60	7.34	14.55	7.70
<b>Cognitive</b>								
Knowledge	16.28	5.06	20.78*	3.81	15.90	7.58	15.60*	6.29
Evaluation	13.22	6.45	13.44	6.30	13.57	7.98	12.07	6.36
Application	17.83	5.97	14.17	4.07	19.27	7.10	14.33	5.75
<b>Content-Cognitive</b>								
Techniques & Knowledge	5.44	3.48	6.78	2.58	7.10	3.41	6.17	3.18
Techniques & Application	5.83	3.76	7.22	3.49	6.33	3.67	6.03	2.91
Techniques & Evaluation	5.78	3.02	4.56	2.81	7.57	4.59	3.93	2.61
Tactics & Knowledge	5.33	2.70	5.66*	2.97	4.73	3.54	3.63*	3.01
Tactics & Application	3.06	3.42	2.78	2.71	3.23	3.09	2.77	2.19
Tactics & Evaluation	6.17	3.83	3.28	3.23	6.17	4.21	3.67	2.68
Rules & Knowledge	5.50	3.13	8.33*	1.28	4.07	3.61	5.80*	3.52
Rules & Application	4.33	2.76	3.44	3.62	4.00	3.81	3.27	3.67
Rules & Evaluation	5.89	2.29	5.72	1.36	5.53	2.67	5.43	2.47
<b>Total Score</b>	47.33	12.46	48.39	11.69	48.73	17.66	42.00	14.98

W.P. unseen written paper; V.P. video based unseen written paper

\*Statistically Significant Differences at the 0.05 level.

The netball participants over the two years prior to the experimental treatment scored higher than the non-participants on two content and cognitive components of the W.P.: rules and knowledge. For the V.P. participants scored higher on all the six content and cognitive domains, except for application. However, from the six main content and cognitive domains the difference between the scores resulted in statistical significance for the knowledge domain of the V.P. only ( $F(1,48)=9.950, p<0.005$ ), in which case, as expected, the netball participants scored higher than the non-participants. When the content-cognitive sub-scores were inspected, there resulted some cases where the scores of the non-participants were higher than those of the participants, however, none of these were found to be statistically significant at the 0.05 level. When the nine

content-cognitive components were examined, the subjects who participated in netball before treatment scored significantly higher on the tactics-knowledge (V.P.) ( $F(1,48)=5.181, p<0.05$ ) and the rules-knowledge (V.P.) ( $F(1,48)=8.586, p<0.005$ ) domains. The total scores of the netball participants were higher for the V.P. ( $m=48.39$ ), whereas for the non-participants, the scores of the W.P. ( $m=48.73$ ) were the highest. However, none of these scores were found to be significantly different for any of the assessment instruments (W.P.:  $F(1,48)=0.087, p=0.770$ ; V.P.:  $F(1,48)=2.391, p=0.129$ ).

The scores of the subjects who participated in physical activities other than netball for the two years before the experimental treatment are provided in table 5.32.

Table 5.32: Netball: Participation in other physical activities and Mean Scores & S.D of content and cognitive domains

<i>Netball</i>	<i>Participation in other activities n=41</i>				<i>Non-participants n=7</i>			
	W.P.		V.P.		W.P.		V.P.	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b><i>Content</i></b>								
Techniques	19.97	6.94	17.71	6.04	16.86	10.91	20.28	4.35
Tactics	9.68	5.85	10.93	6.60	7.29	3.30	9.28	4.19
Rules	14.41	6.91	16.02	6.75	14.29	5.38	13.29	7.49
<b><i>Cognitive</i></b>								
Knowledge	16.39	6.90	17.28	6.36	14.00	4.72	19.00	3.11
Application	19.15	6.67	14.49	5.42	16.28	6.68	13.00	2.94
Evaluation	13.44	7.56	12.88	6.33	13.43	6.70	10.86	6.31
<b><i>Content-Cognitive</i></b>								
Techniques & Knowledge	6.76	3.32	6.24	3.08	4.85	4.33	7.28	1.97
Techniques & Application	6.09	3.62	6.41	2.94	6.43	4.24	6.86	4.45
Techniques & Evaluation	7.12	4.10	3.97	2.74	5.57	4.43	5.28	2.06
Tactics & Knowledge	4.90	3.42	4.32	3.31	5.28	1.97	4.86	1.77
Tactics & Application	3.39	3.35	2.93	2.38	1.86	1.46	1.86	2.27
Tactics & Evaluation	6.29	4.05	3.68	2.90	5.43	4.16	2.57	2.69
Rules & Knowledge	4.73	3.58	6.73	3.13	3.86	2.85	6.85	3.33
Rules & Application	3.95	3.51	3.54	3.65	5.14	2.85	2.14	3.34
Rules & Evaluation	5.73	2.53	5.76	1.99	5.28	2.62	4.28	2.49
<b><i>Total Score</i></b>	48.98	15.98	44.66	14.86	43.71	14.83	42.86	8.53

*W.P. unseen written paper; V.P. video based unseen written paper*

*\*Statistically Significant Differences at the 0.05 level.*

The participants in physical activities scored higher on the majority of the content and cognitive components, their combinations and the total scores for both assessment instruments (W.P., V.P.) with the exception of knowledge (W.P.), techniques-knowledge (V.P.), techniques-evaluation (W.P. and V.P.), techniques-application (V.P.), tactics-knowledge (W.P. and V.P.),

tactics-application (W.P.), and rules-evaluation (W.P.). However, none of these differences were found to be statistically significant.

The total scores of those who participated in physical activities before treatment were found to be higher than those of the subjects who did not participate, for both modes of assessment (W.P. and V.P.). However, there emerged no significant differences for the scores of the two groups for either mode of assessment (W.P.: $F(1,48)=0.660$   $p=0.421$ ; V.P.: $F(1,48)=0.096$ ,  $p=0.758$ ).

The most popular activities practised at recreational level were walking/fitness, netball and football while the most cited competitive activities were football, netball and waterpolo. Some participants practised more than one physical activity. For a list of all the activities mentioned by the respondents see appendix 5.6).

### ***5.7.1 Netball: Testing of hypothesis***

The primary objective of this study was to investigate whether the three different experimental teaching conditions had an effect on the modes of assessing the content (techniques, tactics and rules) and cognitive (knowledge, application and evaluation) domains of netball. May one observe that the content-cognitive aspect of physical activities is being considered independently and as separate from other performance-based assessments aimed at measuring motor skills. Apart from the experimental teaching condition variable, gender, attendance for the sessions, participation in the activity (netball) and participation in other physical activities were considered as factors that would effect the performance of students in written based assessments of PE and Sport Studies.

MANOVA analysis (repeated measures) were performed on the scores obtained by the subjects for each mode of assessment on two occasions (pre-test and post-test). The results for the netball content (techniques, tactics and rules) and cognitive (knowledge, application and evaluation) components, and the total scores of the W.P. and V.P. will be discussed in the following section. Tables 5.33 and 5.34 provide a summary of the statistically significant results indicating the main effects, the first, second and higher order interactions on the dependent variables over the two testing occasions for both modes of assessment. The subsequent sections will present the MANOVA results and the statistically significant descriptive statistics obtained over the two testing occasions.

Table 5.33: Summary of the statistically significant MANOVA results for the netball unseen written paper (n=48) significant at the 0.05 level

<b>Dependent Variables</b>	<b>Main Effects</b>	<b>First order interaction</b>	<b>Second order interactions</b>	<b>Higher order interactions</b>
<b><i>Content</i></b>				
Techniques	_____	_____	_____	_____
Tactics	_____	_____	_____	_____
Rules	_____	_____	_____	_____
<b><i>Cognitive</i></b>				
Knowledge	_____	_____	_____	_____
Evaluation	_____	_____	_____	_____
Application	Gender	_____	_____	_____
<b><i>Total Score</i></b>	_____	_____	_____	_____

Table 5.34: Summary of the statistically significant MANOVA results for the netball video based unseen written paper (n=48) significant at the 0.05 level

<b>Dependent Variables</b>	<b>Main Effects</b>	<b>First order interaction</b>	<b>Second order interactions</b>	<b>Higher order interactions</b>
<b><i>Content</i></b>				
Techniques	_____	_____	_____	_____
Tactics	Attendance	_____	_____	_____
Rules	_____	_____	_____	_____
<b><i>Cognitive</i></b>				
Knowledge	_____	_____	_____	_____
Evaluation	_____	_____	_____	_____
Application	Participation in Netball	_____	_____	_____
<b><i>Total Score</i></b>	Participation in Netball	_____	_____	_____

The synthesis in tables 5.33 and 5.34 show that the null hypotheses relating to gender, attendance and participating in netball are rejected and that the alternative hypotheses are not rejected. These independent variables were found to be statistically significant on one or more of the dependent measures as main effects. The null hypothesis related to the independent variables of experimental teaching conditions, and participating in another physical activity and interactions are not rejected as these did not result in significant differences on any of the dependent variables. The alternative hypothesis for these two variables and interactions are rejected. There emerged no significant interactions of any combinations of the independent variables. The

discussions of the results of the main effects on the dependent variables are presented in the following subsections.

### 5.7.2 Netball Content: Techniques

The MANOVA results for the main effects on techniques are shown in table 5.35. These indicate that there were no statistically significant main effects on either the W.P. or the V.P. Thus, the null hypotheses for experimental teaching conditions, gender, attendance, participation in netball and participating in another activity are accepted and the alternative hypotheses for the techniques content component of both papers are rejected.

Table 5.35: MANOVA results for netball: techniques

	<b>TECHNIQUES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b><i>UNSEEN WRITTEN PAPER (W.P.)</i></b>					
1	Experimental teaching conditions	29.845	2	14.922	0.393	0.678 NS
2	Gender	64.544	1	64.544	1.701	0.202 NS
3	Attendance	8.709	1	8.709	0.229	0.636 NS
4	Participating in Netball	0.118	1	0.118	0.003	0.956 NS
5	Participating in another activity	32.139	1	32.139	0.847	0.365 NS
	<b><i>VIDEO BASED UNSEEN WRITTEN PAPER (VIDEO)</i></b>					
1	Experimental teaching conditions	44.660	2	22.330	1.040	0.366 NS
2	Gender	63.825	1	63.825	2.973	0.095 NS
3	Attendance	6.587	1	6.587	0.307	0.584 NS
4	Participating in Netball	21.847	1	21.847	1.018	0.321 NS
5	Participating in another activity	40.993	1	40.993	1.909	0.178 NS

The incidence of no statistically significant main effects of the independent variables, in particular in the case of the three experimental teaching conditions (W.P.  $p=0.678$ ; V.P.  $p=0.366$ ) can be explained by the fact that the increase of scores from pre-test to post-test was not significantly different among the groups. The increases of the scores from occasion 1 to occasion 2 for both the W.P. and the V.P. are shown in table 5.36.

Table 5.36: Netball: Means and Standard Deviation scores for techniques and experimental teaching conditions.

<b>Netball</b>	<b>ETU 1</b>	<b>ETU 2</b>	<b>ETU 3</b>
<b>Content: techniques</b>	<b>N= 20</b>	<b>N=12</b>	<b>N=16</b>
<b><i>Unseen written paper (W.P.)</i></b>	<b><i>M (S.D.)</i></b>	<b><i>M (S.D.)</i></b>	<b><i>M (S.D.)</i></b>
Occasion 1 (pre-test)	6.40 (7.01)	0.33 (1.15)	2.12 (3.67)
Occasion 2 (post-test)	23.25 (8.18)	17.62 (7.54)	16.06 (4.51)
<i>Increase in score between occasions</i>	<i>16.85</i>	<i>17.29</i>	<i>13.94</i>
<b><i>Video based unseen written paper (V.P.)</i></b>			
Occasion 1 (pre-test)	9.20 (8.17)	5.42 (4.87)	6.87 (4.69)
Occasion 2 (post-test)	17.50 (5.61)	18.67 (7.40)	18.37 (5.15)
<i>Increases in score between occasions</i>	<i>8.3</i>	<i>13.25</i>	<i>11.5</i>

### 5.7.3 Netball Content: Tactics

The null hypothesis for attendance for the tactics domain of the V.P. is rejected and the alternative hypothesis is not rejected. The null hypotheses for the W.P. for the tactics domain is accepted for all dependant variables and the alternative hypotheses are rejected. The results for the MANOVA scores are presented in table 5.37.

Table 5.37: MANOVA results for netball: tactics

	<b>TACTICS</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b>UNSEEN WRITTEN PAPER (W.P.)</b>					
1	Experimental teaching conditions	6.006	2	3.003	0.207	0.814 NS
2	Gender	9.017	1	9.017	0.621	0.437 NS
3	Attendance	10.624	1	10.624	0.731	0.400 NS
4	Participating in Netball	30.412	1	30.412	2.093	0.159 NS
5	Participating in another activity	4.849	1	4.849	0.334	0.568 NS
	<b>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</b>					
1	Experimental teaching conditions (ETU)	56.811	2	28.406	1.349	0.275 NS
2	Gender	4.297	1	4.297	0.204	0.655 NS
3	Attendance	91.340	1	91.340	4.339	0.046
4	Participating in Netball	63.362	1	63.362	3.010	0.093 NS
5	Participating in another activity	0.829	1	0.829	0.039	0.844 NS

Attendance emerged as a statistically significant factor ( $p < 0.05$ ) for the tactics domain of the V.P. as the subjects who attended for the entire sessions outperformed those who missed one session, as can be seen in table 5.38. This can be explained by the substantial increase in the score from the first to the second occasion for the group who attended all the sessions

Table 5.38: Netball: Means and Standard Deviation scores for tactics and attendance.

<b>Netball Content: tactics</b>	<b>Attended all sessions N=31</b>	<b>Missed one session N=17</b>
<b>Video based unseen written paper (V.P.)</b>	<b>M (S.D.)</b>	<b>M (S.D.)</b>
Occasion 1 (pre-test)	6.03 (5.34)	5.00 (4.58)
Occasion 2 (post-test)	12.70 (6.28)	7.00 (4.50)

### 5.7.4 Netball Content: Rules

The null hypotheses for the rules content component are accepted for all independent variables for both modes of assessment since there resulted no statistically significant main effects, as can be seen in table 5.39. The alternative hypotheses are rejected.

Table 5.39: MANOVA results for netball: rules

	<b>RULES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>P</b>
	<b>UNSEEN WRITTEN PAPER (W.P.)</b>					
1	Experimental teaching conditions	0.044	2	0.022	0.001	0.999 NS
2	Gender	16.818	1	16.818	1.047	0.315 NS
3	Attendance	12.971	1	12.971	0.807	0.376 NS
4	Participating in Netball	51.597	1	51.597	3.211	0.084 NS

	<b>RULES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>P</b>
5	Participating in another activity	0.003	1	0.003	0.000	0.989 NS
	<b>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</b>					
1	Experimental teaching conditions	79.064	2	39.532	2.272	0.121 NS
2	Gender	0.125	1	0.125	0.007	0.933 NS
3	Attendance	0.681	1	0.681	0.039	0.845 NS
4	Participating in Netball	41.942	1	41.942	2.411	0.131 NS
5	Participating in another activity	25.044	1	25.044	1.439	0.240 NS

### 5.7.5 Netball Cognitive: Knowledge

The null hypotheses for the knowledge cognitive domain are accepted, and the alternative hypotheses are rejected for all independent variables for both modes of assessment (W.P. and V.P.). There resulted no statistically significant main effects, as can be seen in table 5.40.

Table 5.40: MANOVA results for netball: knowledge

	<b>KNOWLEDGE</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b>UNSEEN WRITTEN PAPER (W.P.)</b>					
1	Experimental teaching conditions	68.611	2	34.306	1.346	0.276 NS
2	Gender	11.603	1	11.603	0.455	0.505 NS
3	Attendance	1.058	1	1.058	0.042	0.840 NS
4	Participating in Netball	0.509	1	0.509	0.020	0.889 NS
5	Participating in another activity	0.008	1	0.008	0.000	0.985 NS
	<b>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</b>					
1	Experimental teaching conditions	5.690	2	2.845	0.119	0.888 NS
2	Gender	37.772	1	37.772	1.585	0.218 NS
3	Attendance	7.326	1	7.326	0.307	0.584 NS
4	Participating in Netball	23.608	1	23.608	0.991	0.328 NS
5	Participating in another activity	43.697	1	43.697	1.834	0.186 NS

### 5.7.6 Netball Cognitive: Application

The null hypothesis for gender for the W.P. is rejected and the alternative hypothesis is not accepted. For the V.P. the null hypothesis for participation in netball is also rejected and the alternative hypothesis is not rejected. The MANOVA results are given in table 5.41.

Table 5.41: MANOVA results for netball: application

	<b>APPLICATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b>UNSEEN WRITTEN PAPER (W.P.)</b>					
1	Experimental teaching conditions	31.574	2	15.787	0.822	0.450 NS
2	Gender	145.088	1	145.088	7.550	0.010
3	Attendance	0.655	1	0.655	0.034	0.855 NS
4	Participating in Netball	1.622	1	1.622	0.084	0.773 NS
5	Participating in another activity	2.798	1	2.798	0.146	0.706 NS

	<b>APPLICATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b><i>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</i></b>					
1	Experimental teaching conditions (ETU)	22.626	2	11.313	0.710	0.500 NS
2	Gender	15.912	1	15.912	0.999	0.326 NS
3	Attendance	10.924	1	10.924	0.686	0.414 NS
4	Participating in Netball	88.584	1	88.584	5.560	0.025
5	Participating in another activity	12.560	1	12.560	0.788	0.382 NS

There resulted significant main effects for gender for the W.P. ( $p < 0.05$ ). From table 5.42 it is evident that at pre-test level females scored higher than males, and at post-test level females improved their score over that of males.

Table 5.42: Netball: Means and Standard Deviation scores for application and gender

<b><i>Netball Cognitive: Application Unseen written paper (W.P.)</i></b>	<b><i>Females N=31 M (S.D.)</i></b>	<b><i>Males N=17 M (S.D.)</i></b>
Occasion 1 (pre-test)	3.58 (3.98)	2.18 (5.70)
Occasion 2 (post-test)	20.00 (6.29)	16.41 (6.90)

Participation in netball also showed up as a significant main effect for the cognitive component of application for the V.P ( $p < 0.05$ ). This can be explained as the subjects who took part in netball before the experimental treatment scored higher than the other group at pre-test level. However, the scores on the second occasion were very similar, thus, the group who did not participate in netball improved the scores more than the netball participants. (Occasion 2: Participated in netball:  $m=14.17$   $S.D=4.08$ ; Did not participate in netball  $m=14.33$   $S.D.=5.75$ ).

### ***5.7.7 Netball Cognitive: Evaluation***

The MANOVA results given in table 5.43 show that there resulted no statistically significant main effects, thus, the null hypothesis for the evaluation cognitive component is accepted for all independent variables for both modes of assessment and the alternative hypotheses are rejected.

Table 5.43: MANOVA results for netball: evaluation

	<b>EVALUATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b><i>UNSEEN WRITTEN PAPER (W.P.)</i></b>					
1	Experimental teaching conditions	9.520	2	4.760	0.277	0.760 NS
2	Gender	62.933	1	62.933	3.660	0.066 NS
3	Attendance	2.202	1	2.202	0.128	0.723 NS
4	Participating in Netball	5.980	1	5.980	0.348	0.560 NS
5	Participating in another activity	0.008	1	0.008	0.000	0.983 NS

	<b>EVALUATION</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b><i>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</i></b>					
1	Experimental teaching conditions	9.457	2	4.729	0.179	0.837 NS
2	Gender	4.848	1	4.848	0.183	0.672 NS
3	Attendance	78.297	1	78.297	2.957	0.096 NS
4	Participating in Netball	16.249	1	16.249	0.614	0.440 NS
5	Participating in another activity	0.991	1	0.991	0.037	0.848 NS

### 5.7.8 Netball: Total Scores

For the V.P. the null hypothesis for participation in netball is rejected and the alternative hypothesis is not rejected. The null hypotheses for the netball total scores of the W.P. are accepted for all independent variables and the alternative hypotheses are rejected. Table 5.44 gives the MANOVA results for the netball total scores.

Table 5.44: MANOVA results for netball: total scores

	<b>TOTAL SCORES</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>P</b>
	<b><i>UNSEEN WRITTEN PAPER (W.P.)</i></b>					
1	Experimental teaching conditions	26.411	2	13.206	0.157	0.855 NS
2	Gender	274.632	1	274.632	3.267	0.081 NS
3	Attendance	2.899	1	2.899	0.034	0.854 NS
4	Participating in Netball	0.210	1	0.210	0.003	0.960 NS
5	Participating in another activity	2.806	1	2.806	0.033	0.856 NS
	<b><i>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</i></b>					
1	Experimental teaching conditions	95.657	2	47.828	0.752	0.481 NS
2	Gender	108.471	1	108.471	1.705	0.202 NS
3	Attendance	167.677	1	167.677	2.635	0.115 NS
4	Participating in Netball	365.207	1	365.207	5.740	0.023
5	Participating in another activity	5.329	1	5.329	0.084	0.774 NS

Participation in netball resulted as a significant main effect for the total scores of the V.P ( $p < 0.05$ ). This can be explained as the subjects took part in netball before the experimental treatment scored higher than the other group at pre-test and at post-test levels.

Table 5.45: Netball: Means and Standard Deviation scores for total scores and participation in netball

<b><i>Netball Total scores</i></b>	<b><i>Participated in netball N=18</i></b>	<b><i>Did not participate in netball N=30</i></b>
<b><i>Video based unseen written paper (Video)</i></b>	<b><i>M (S.D.)</i></b>	<b><i>M (S.D.)</i></b>
Occasion 1 (pre-test)	22.56 (13.60)	18.87 (12.33)
Occasion 2 (post-test)	48.39 (11.69)	42.00 (14.98)

## 5.8 Athletics and Netball: Testing of hypotheses

In this section the main effects of the physical activities, namely athletics and netball, will be discussed. The aim is to attempt to show any differences in the results of the dependant variables (the total scores, the sub-scores of the three content (techniques, tactics and rules) and the three cognitive (knowledge, application and evaluation) components), with respect to the two modes of assessments (W.P. and V.P.). Reference will also be made to other independent variables, (the experimental teaching condition, the gender of the students, attendance for the sessions, previous participation in athletics/netball before the experimental treatment and previous participation in other sport activities), when these contributed to statistically significant results.

One way analysis of variance (ANOVA) will be used to measure any significant differences resulting on the two assessment instruments at post-test. A six-way multiple analysis of variance (repeated measures) MANOVA will be used to test the hypothesis of differences of results of the assessments from occasion one to occasion two on both modes of assessments. This analysis produced results for six main effects and a series of combinations with respect to first order, second order, third order and higher order interactions. The statistically significant results of these analyses are presented in the following section.

From the ANOVA procedure on the post-test scores of the athletics and the netball subjects, there resulted statistically significant differences between the two modes of assessments. The athletics group scored significantly different from the netball group on the tactics questions of the W.P. ( $F(1,97)=6.51$   $p<0.05$ ). These subjects achieved a higher score than did the netball group. On the other hand, the netball group achieved higher scores than the athletics group on both modes of assessment for the total scores (W.P.:  $F(1,97)=16.118$   $p<0.001$ ; V.P.:  $F(1,97)=6.059$   $p<0.05$ ), evaluation (W.P.:  $F(1,97)=12.679$   $p<0.001$ ; V.P.:  $F(1,97)=11.980$   $p<0.001$ ), and techniques (W.P.:  $F(1,97)=58.118$   $p<0.001$ ; V.P.:  $F(1,97)=29.691$   $p<0.001$ ) questions. The netball group also achieved higher scores on the knowledge questions of the V.P. ( $F(1,97)=7.106$   $p<0.01$ ) and on the application questions of the W.P. ( $F(1,97)=18.790$   $p<0.001$ ). These results imply that the physical activities and the different modes of assessments had an impact on the content components of techniques and tactics but not on rules. There was also a significant effect on all the three cognitive components of knowledge, application and evaluation.

Further analysis of main effects and interactions of the independent variables on the content and cognitive domains and the total scores of the two modes of assessments resulted in a number of first, second and third order interactions as shown in tables 5.46 and 5.47.

Table 5.46: Summary of the statistically significant MANOVA for the combined results of athletics and netball for the unseen written paper (n=97) significant at the 0.05 level

<b>Dependent Variables</b>	<b>Main Effects</b>	<b>First order interaction</b>	<b>Second order interactions</b>	<b>Higher order interactions</b>
<b><i>Content</i></b>				
Techniques	Physical Activity	_____	_____	_____
Tactics	Gender Attendance	_____	_____	_____
Rules	Exp. Teaching Condition	_____	_____	_____
<b><i>Cognitive</i></b>				
Knowledge	_____	_____	_____	_____
Application	Physical Activity Gender	_____	_____	_____
Evaluation	Gender	_____	_____	_____
<b><i>Total Score</i></b>	Physical Activity Gender	_____	_____	_____

Table 5.47: Summary of the statistically significant MANOVA for the combined results of athletics and netball for the video based unseen written paper (n=97) significant at the 0.05 level

<b>Dependent Variables</b>	<b>Main Effects</b>	<b>First order interaction</b>	<b>Second order interactions</b>	<b>Higher order interactions</b>
<b><i>Content</i></b>				
Techniques	Exp. Teaching Condition	Exp. Teaching Condition x Physical Activity	_____	_____
Tactics	Exp. Teaching Condition	Exp. Teaching Condition x Physical Activity	_____	_____
Rules	_____	Exp. Teaching Condition x Physical Activity  Physical Activity x Attendance	Exp. Teaching Condition x Physical Activity x Attendance	_____
<b><i>Cognitive</i></b>				
Knowledge	_____	Exp. Teaching Condition x Physical Activity  Exp. Teaching Condition x Attendance  Physical Activity x Attendance	_____	_____
Application	Exp. Teaching Condition	Exp. Teaching Condition x Physical Activity	_____	_____
Evaluation	Exp. Teaching Condition	Exp. Teaching Condition x Physical Activity	_____	_____

<b>Dependent Variables</b>	<b>Main Effects</b>	<b>First order interaction</b>	<b>Second order interactions</b>	<b>Higher order interactions</b>
<b>Total Score</b>	Exp. Teaching Condition	Exp. Teaching Condition x Physical Activity Physical Activity x Attendance	_____	_____

The summary of the MANOVA results in tables 5.46 and 5.47 show that the null hypotheses relating to experimental teaching conditions, the physical activities (athletics/netball), gender and attendance are rejected and that the alternative hypotheses are not rejected. These independent variables were found to be statistically significant on one or more of the dependent measures as main effects and in interactions with one or more variables. The null hypothesis that is related to the independent variable of participating in another physical activity is not rejected as this did not result in significant differences on any of the dependent variables. The alternative hypothesis is rejected.

The following sections include the results and the discussion of the statistically significant main effects and the interactions on the dependent variables (the content and cognitive) domains and the total scores for each of the W.P. (table 5.48) and the V.P. (table 5.50).

Table 5.48: MANOVA results for athletics and netball: unseen written paper

	<b>UNSEEN WRITTEN PAPER (W.P.)</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b>TECHNIQUES</b>					
1	Physical Activity	178.26	1	178.26	5.85	0.018
	<b>TACTICS</b>					
1	Gender	64.89	1	64.89	4.17	0.045
2	Attendance	119.88	1	119.88	7.69	0.007
	<b>RULES</b>					
1	Experimental teaching conditions (ETU)	142.16	2	71.08	4.38	0.016
	<b>APPLICATION</b>					
1	Physical Activity	179.39	1	179.39	9.83	0.003
2	Gender	101.35	1	101.35	5.56	0.021
	<b>EVALUATION</b>					
1	Gender	132.67	1	132.67	9.00	0.004
	<b>TOTAL SCORE</b>					
1	Physical Activity	726.52	1	726.52	8.23	0.005
2	Gender	683.94	1	683.94	7.75	0.007

For the W.P. the null hypotheses for physical activity are rejected and the alternative hypotheses are not rejected for the following domains: techniques, application and total scores. The null hypothesis for gender is also rejected and the alternative hypothesis is accepted for tactics, application, evaluation and the total scores. The null hypothesis for attendance is rejected for the

tactics domain and the alternative hypothesis is not rejected. In the case of the ETUs the null hypothesis is rejected for rules and the alternative hypothesis is not rejected. The null hypotheses for the interactions are accepted, since these were not significant. There were no main effects on the cognitive component of knowledge.

The statistical significance for physical activity for the W.P. ( $p<0.05$ ) is explained by the substantial increase in the score from occasion 1 to occasion 2 of the netball group, who scored higher than the athletics groups for techniques, application and the total scores. The mean values and standard deviations of these independent variables are given in table 5.49.

Table 5.49 Athletics and Netball: Means and Standard Deviation scores for physical activities for the unseen written paper

PHYSICAL ACTIVITIES	<i>Netball N=48</i>		<i>Athletics N=49</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Techniques (W.P.)				
Occasion 1	3.46	5.59	2.57	3.73
Occasion 2	19.52	7.58	8.33	6.87
Application (W.P.)				
Occasion 1	3.08	4.65	3.71	4.38
Occasion 2	18.73	6.67	12.96	6.44
Total Score (W.P.)				
Occasion 1	9.79	13.60	12.73	10.85
Occasion 2	48.21	15.78	35.12	16.31

The experimental teaching conditions emerged as a significant main effect for rules ( $p<0.05$ ). This can be explained by the significant improvement of the Sports Studies groups (class-based sessions) from occasion one to two, and the out performance on the other groups (ETU1:  $m=15.15$  S.D=6.90; ETU2:  $m=10.43$  S.D=4.99; ETU3:  $m=18.71$  S.D=6.72). Gender also showed up as a significant main effect for the tactics ( $p<0.05$ ), application ( $p<0.05$ ) and evaluation ( $p<0.005$ ) components and this is attributed to the higher scores achieved by female subjects. Attendance resulted in a significant main effect for tactics ( $p<0.01$ ), where the attending group achieved higher scores than the non-attending group.

In the case of the V.P. (table 5.50), there were more significant main effects and interactions than observed for the W.P. The null hypotheses for experimental teaching conditions and physical activity are rejected for all the content and cognitive domains, namely, techniques, tactics, rules, knowledge, application, evaluation and the total scores. The alternative hypotheses are not rejected. The null hypothesis for attendance is also rejected for the content domain of rules and the cognitive domain of knowledge, and for the total score. The alternative hypotheses are not rejected.

Table 5.50: MANOVA results for athletics and netball: video based unseen written paper

	<b>VIDEO BASED UNSEEN WRITTEN PAPER (V.P.)</b>	<b>SS</b>	<b>d.f.</b>	<b>MS</b>	<b>F-ratio</b>	<b>p</b>
	<b><i>TECHNIQUES</i></b>					
1	Experimental teaching conditions (ETU)	225.52	2	112.76	5.39	0.007
2	ETU x Physical Activity	247.12	2	123.56	5.90	0.004
	<b><i>TACTICS</i></b>					
1	Experimental teaching conditions (ETU)	241.88	2	120.94	5.99	0.004
2	ETU x Physical Activity	184.72	2	92.36	4.57	0.014
	<b><i>RULES</i></b>					
1	ETU x Physical Activity	455.82	2	227.91	11.77	0.000
2	Physical Activity x Attendance	98.35	1	98.35	5.08	0.027
3	ETU x Physical Activity x Attendance	80.88	1	80.88	4.18	0.045
	<b><i>KNOWLEDGE</i></b>					
1	ETU x Physical Activity	232.24	2	116.12	5.32	0.007
2	ETU x Attendance	150.73	2	75.36	3.45	0.037
3	Physical Activity x Attendance	93.92	1	93.92	4.30	0.042
	<b><i>APPLICATION</i></b>					
1	Experimental teaching conditions (ETU)	343.78	2	171.89	9.87	0.000
2	ETU x Physical Activity	354.92	2	177.46	10.19	0.000
	<b><i>EVALUATION</i></b>					
1	Experimental teaching conditions (ETU)	184.24	2	92.12	5.06	0.009
2	ETU x Physical Activity	326.43	2	163.22	8.96	0.000
	<b><i>TOTAL SCORE</i></b>					
1	Experimental teaching conditions (ETU)	1597.95	2	798.98	9.54	0.000
2	ETU x Physical Activity	2573.27	2	1286.63	15.36	0.000
3	Physical Activity x Attendance	346.74	1	346.74	4.14	0.046

The statistical significance of the main effects of the ETU ( $p < 0.01$ ) is explained by the incidence of the out performance of the Sport Studies group for each dependent variable. The interaction of the ETUs and the physical activity ( $p < 0.05$ ) on all the dependent variables is also attributed to the high scores of the athletics Sport Studies group (class-based sessions). This group out performed the other athletics and netball groups on the second occasion of testing using the V.P. It is also observed that the netball Sport Studies group (class-based sessions) improved its scores significantly on tactics and knowledge, while the netball Physical Education Coursework group (practice-based sessions and handout), improved their score significantly for techniques, rules, application and evaluation. The means and standard deviations of these dependent variables and the improvements in scores from the first to the second occasion are given in table 5.51.

Table 5.51: Athletics and Netball: Means and Standard Deviation scores for ETUs and physical activities of the video based unseen written paper

ETU	Physical Education (Practice-based sessions)				Physical Education Coursework (Practice-based sessions and handout)				Sport Studies (Class based sessions)			
	Netball N=20		Athletics N=12		Netball N=12		Athletics N=25		Netball N=16		Athletics N=12	
Physical Activity	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
<b>Techniques</b>												
Occasion 1	9,20	8,17	4,00	4,18	5,42	4,87	1,48	2,57	6,88	4,69	4,92	4,03
Occasion 2	17,50	5,61	7,75	6,45	18,67	7,40	5,16	4,86	18,38	5,15	20,75	9,07
Increase in score	<b>8,30</b>		<b>3,75</b>		<b>13,25</b>		<b>3,68</b>		<b>11,50</b>		<b>15,83</b>	
<b>Tactics</b>												
Occasion 1	6,90	4,70	9,42	6,63	7,50	5,52	6,56	4,78	2,75	3,99	6,75	3,77
Occasion 2	9,60	7,33	13,25	7,26	13,25	5,07	8,36	4,73	10,13	5,50	19,00	6,37
Increase in score	<b>2,70</b>		<b>3,83</b>		<b>5,75</b>		<b>1,80</b>		<b>7,38</b>		<b>12,25</b>	
<b>Rules</b>												
Occasion 1	7,25	5,86	5,92	5,05	5,83	3,97	4,56	5,39	7,88	5,00	7,17	5,15
Occasion 2	15,80	6,44	14,00	3,79	15,25	9,21	7,69	4,73	15,69	5,68	25,50	3,75
Increase in score	<b>8,55</b>		<b>8,08</b>		<b>9,42</b>		<b>3,13</b>		<b>7,81</b>		<b>18,33</b>	
<b>Knowledge</b>												
Occasion 1	8,95	8,16	9,08	5,96	8,25	7,37	5,64	4,98	5,13	5,82	9,50	4,36
Occasion 2	17,30	4,61	14,83	7,18	16,83	8,74	8,52	5,87	18,38	5,38	23,00	4,18
Increase in score	<b>8,35</b>		<b>5,75</b>		<b>8,58</b>		<b>2,88</b>		<b>13,25</b>		<b>13,50</b>	
<b>Application</b>												
Occasion 1	9,00	5,26	6,00	4,79	7,33	3,08	3,64	3,88	10,19	4,85	4,92	3,09
Occasion 2	13,35	5,56	16,42	6,13	12,92	4,60	7,80	4,54	13,81	3,33	25,25	10,04
Increase in score	<b>4,35</b>		<b>10,42</b>		<b>5,59</b>		<b>4,16</b>		<b>3,62</b>		<b>20,33</b>	
<b>Evaluation</b>												
Occasion 1	6,55	5,53	3,00	3,86	5,17	4,80	2,40	3,44	4,00	2,87	2,25	2,60
Occasion 2	12,25	6,48	7,25	3,44	13,92	7,05	4,24	3,48	12,00	5,74	16,42	6,84
Increase in score	<b>5,70</b>		<b>4,25</b>		<b>8,75</b>		<b>1,84</b>		<b>8,00</b>		<b>14,17</b>	
<b>Total Score</b>												
Occasion 1	23,35	15,99	19,33	13,25	18,75	9,31	12,60	10,05	17,50	10,19	18,83	8,10
Occasion 2	42,90	12,81	35,00	12,23	47,17	19,04	21,44	11,50	44,19	11,69	64,25	16,13
Increase in score	<b>19,55</b>		<b>15,67</b>		<b>28,42</b>		<b>8,84</b>		<b>26,69</b>		<b>45,42</b>	

There emerged a statistically significant interaction for physical activities and attendance for rules ( $p < 0.05$ ), knowledge ( $p < 0.05$ ) and total scores ( $p < 0.05$ ). This can be explained by the fact that the group who attended all the netball sessions, increased the scores from occasion 1 to 2 much more than the other groups, as well as achieving the highest scores on these dependent variables. The interaction between the ETUs and attendance for knowledge ( $p < 0.05$ ) is the result of the high learning gains and scores achieved by the Sport Studies groups (class-based sessions) for both the attending group and those who missed one session. The interaction between the physical activity, ETU and attendance for rules ( $p < 0.05$ ) is explained by the fact that the Sport Studies athletics class earned the highest learning gains and scores for both the attending group and those who missed one session.

## **5.9 Student evaluation of the modes of teaching and assessments**

The subjects who participated in the three ETUs were requested to give written feedback about both the teaching methods and the modes of assessment. Precaution was again taken to gather unbiased responses, thus, this exercise was done a week after the second assessment occasion. The evaluation exercise was conducted by the school contact PE teacher who was guided about the nature of the exercise and its administration by the researcher. It was considered appropriate not to have the feedback statements kept anonymous mainly to be able to identify subjects for possible further clarifications as well as to be able to weigh up their statements against their attendance record for instance.

Teachers were requested to organise the participants in a class session and they were to encourage the subjects to complete the evaluation exercise without consulting or discussing the questions with each other. Participants were also encouraged to write either in English or Maltese, such that there would not be language barriers hindering the expression of their opinions.

There were three evaluation sheets, one for each of the experimental teaching conditions namely Physical Education (ETU 1: practice-based sessions), Physical Education Coursework (ETU 2: practice-based sessions and handout) and Sports Studies (ETU 3: class-based sessions). Each evaluation sheet was divided into two parts, one on the teaching sessions and the other on the two modes of assessment. The questions on the sessions varied for the ETUs as these included specific references to issues such as the use of handouts, worksheets, video clips and written activities during the sessions. The part about assessments was identical for the three evaluation sheets (see appendix 3.28).

The following discussion includes the feedback of the participants on the teaching sessions and the assessment instruments. It is worth noting that the feedback of all the subjects, including those who missed more than one session has been included in the discussion. The number of subjects in each group is indicated in parenthesis in the relevant sections.

### ***5.9.1 Physical Education: Athletics (16 participants)***

#### ***The sessions***

All the students from the two classes who formed this group enjoyed these practical sessions. They were taught by two different teachers. Students from both classes commented positively on the teaching method. One participant found it “good, since it was quite modern and maybe unusual” while another noted and commented on “many new methods”. Many students from both classes commented on the clarity of explanations. The impact of the method ranged

from putting participants “in the right attitude to run” for instance, to “looking forward” to the next session and increased interest in the exercises for the athletics activities. Some participants did not feel that the teaching method had any effect on them.

Most participants enjoyed the variety of activities presented during each session. One participant appreciated that they “could do different activities each time e.g. sprints, relay and shot” as opposed to spending a whole lesson on running. Others mentioned specific activities such as “running”, “the shot” and particular lead up activities they found amusing because of the fun element. The use of a variety of equipment (Olympic starting blocks, batons, medicine balls, the shot put, measuring tape, and tennis balls) was what made the session enjoyable to students in one of the two classes. Some participants disliked specific activities during the sessions such as the shot and running because they felt they were not physically built for it. Another participant disliked the sessions because it was felt that “we should have been given more information about the sport in order to answer the questions better”. It must be noted that this participant missed two from five sessions, however, the comment regarding the importance and the need felt for more depth of content is still very relevant and appreciated. Some students from the class who had the sessions organised in the gymnasium (because there wasn’t an athletics track accessible to the school) commented on the fact that they did not like to practice running inside the gymnasium. A participant from the other class who had access to an athletics track commented on “the lack of proper lines and lane marking” on the track. One student found the sessions short (one hour 15 minutes).

All the participants in this group rated themselves as having improved their knowledge of athletics over the treatment period. One subject felt that there was no improvement however an inspection of the pre-and post-test scores showed learning gains on both the W.P. (23 points) and the V.P. (6 points).

### ***The assessment***

Most participants found the questions of the W.P. “clear” but “difficult/moderate” to answer. Some would have appreciated more diagrams. The V.P. was found “easier with the help of video clips”, however some participants felt that the video clips “did not show all the detail which was needed to answer the questions”. Other participants thought the opposite: “some of the video clips give clear hints to answer the questions” and they “help you visualise the questions”. Some subjects found the video clips too short to understand and another participant preferred to have some kind of commentary with the video clip. It must be noted that these participants were not shown any video clips during their lessons. The majority of the participants described the frequency of viewing the video clips (i.e. twice at the beginning and once at the end) adequate.

One participant acknowledged that it was very useful for verification at the end, however some thought there was no need for repetition of the video clips. In one of the classes, most subjects preferred the W.P. whereas in the other class the majority favoured the V.P. The idea of oral assessments was met with a variety of opinions. Some found it a good idea as it was thought that “communication would be more effective” as it seems that it is believed to be easier to explain something about sports orally as you can “explain much more”. Another participant felt that oral and written work could supplement each other while some others were against oral assessments for PE all together.

### ***5.9.2 Physical Education Coursework: Athletics (33 participants)***

#### ***The sessions***

The participants in this group were exposed to identical treatment given to the Physical Education: Athletics class, however, in addition to that, a handout was discussed at the end of each session and was given to each subject to take away. The opinion of subjects concerning the teaching method and its effect was also very positive. Subjects’ comments about the teaching method included: “informative”, “good and interesting”, “it was fun and I looked forward to the lesson”. Another subject felt that the method was a source of motivation “to pay more attention” and another participant added that it “made us want to know and learn more about athletics even though not all (of us) like athletics”. One participant found the teaching method good but did not like it while another noted, “concerning the practical, it was very interesting, helpful and unusual” however it was “annoying ...during PE there must be practical sessions without handouts”. On the other hand the majority of the participants found the handouts “very relevant”, “well explained” and “interesting”. Some subjects felt that the handouts were not needed “because we practised those things in the session” and although they were filed, there was “no use of them”. Most subjects stated that they filed them for future reference.

It was interesting to observe that most participants in this group regarded the pre and post-tests as exercises, as in fact they had been announced by the researcher, and most students found the “video sessions” (i.e. pre-test and post-test) as the most enjoyable part of the sessions. A limited few attributed their likes and dislikes of the sessions to specific activities practised during the sessions and the use of equipment. One subject liked the “relation with the teacher” while another enjoyed the interaction between the students in the class. Two girls in a male dominated class disliked doing exercises which they described as “embarrassing” while one subject did not like being video-filmed doing these exercises in particular. One subject disliked “having to be accurate in everything you practice” while another subject disliked the sessions because “we generally talked and not played”. Quite a few subjects

commented on the unhappiness with the location where the sessions were held, as the gym was not regarded as so good for running. Both classes were in schools that did not have access to an athletics track. In this experimental teaching condition all the subjects but two rated themselves as improving their knowledge over the sessions. On inspection of the pre-and post-test scores of these two subjects, it emerged that one subject had attended for the pre-test and for none of the sessions, while the other had showed learning gains on both the W.P. (2 points) and the V.P. (23 points).

### ***The assessment***

Students in both of the classes unanimously found the questions in both papers as “very difficult” to answer. Most preferred the V.P. as “you get ideas” and “you can understand more”. A couple found that the use of video clips “confused them” while a couple of others preferred to give one’s opinion from general examples instead of having to comment on “what happened exactly in the video”. It must be observed that the subjects in this experimental teaching condition were not shown any video clips during their lessons. The idea of an oral assessment again received a variety of responses. Very few found it a good idea and were in favour of it. Some participants emphatically stated that “there shouldn’t be any type of exams, oral/written in PE”, just practice.

### **5.9.3 *Sport Studies: Athletics (11 participants)***

#### ***The sessions***

Students in this experimental treatment attended class-based sessions and it was explained to them that they could go and practice during the school organised athletics activities during the mid-day break. It was not easy for the students to accept this “Sport Studies” teaching situation and comments like “PE shouldn’t consist of theory” and “ I prefer doing PE in the gym rather than theory” were aired by some of the participants. Other comments on the teaching method were that it was found “better and unusual, but not in sports” and that it is “not bad, but boring”. Most subjects were very straightforward in their comments, which is a good sign as far as genuine feedback is concerned. However, it is worrying to read that “I think it (the teaching method) had a negative effect on my attitude towards the sessions”, in particular when one considers that for athletics, it was precisely in this experimental teaching condition that the highest learning gains were scored for most of the content and cognitive components of the course content.

The handouts were described as “very/fairly relevant” and “very good” and one subject commented that they “helped you learn something”. Most subjects stated that they filed the handouts however one subject commented that there was no use of these handouts as there

were no personal plans in pursuing participation in athletics. The video clips shown and discussed during the lessons were described as an enjoyable part of the session, “quite useful” yet “not very helpful”. One subject found them “meaningful only towards the end of the course”. Others found video clip watching “better than writing” while one subject preferred to be “shown in a practical setting”. Most subjects did not take the written exercises as a positive experience. They were found “a bit” or “not so meaningful” while one subject found them “very stressing”. Another participant again noted that there was a preference to “playing rather than writing”.

Participants in the class-based athletics class enjoyed “discussions on sports” and hearing about this “new sport”. There was a unanimous tune of dislike of the written exercises and the idea of sitting in class instead of a practical session with the use of equipment.

#### ***The assessment***

One participant described the questions for the W.P. as “simple” and some of the others found the V.P. slightly more difficult to tackle. The time for the W.P. was “not enough” for one participant. The use of the video clips was not strongly appreciated by this group as some found that the “video clips did not give much additional information” and one commented that the relationship between the video clips and the questions was not clear. With regards to the frequency of video viewing, a few felt that it was not necessary to view the video clips twice, while many others found it useful to repeat the video clips at the end. One participant felt that there were “few” video clips. The oral assessment did not receive support from any subject in this group. Two participants categorically stated that “sports must not be assessed” and that “assessments would really spoil all the fun in sports”.

#### ***5.9.4 Physical Education: Netball (16 participants)***

##### ***The sessions***

There were two classes in two different schools being exposed to this experimental teaching treatment. In both cases the classes were small in size (11 and 9 participants respectively). Participants found the teaching method “good” and one student commented that the “teaching of the technique was excellent but maybe if we played more games it would have been more interesting”. Another student found the small-sided activities involving techniques and tactics, as opposed to a full-scale game throughout the session as a source of “losing interest sometimes.” This situation was a result of two things, firstly, the mixture of beginners and advanced players together and secondly the small sizes of the class, given that there were absentees for every session. Another reason was that the majority of the activities offered to other students during this time (in both schools) involved playing full-scale games such as

volleyball, football and tennis. One student was conscious of this situation and observed that “we never played the real game because we were few students”. Another participant was sympathetic to the beginner-advanced level and commented that “the teacher helped us as much as she could and even if there were other students who already knew playing, she helped those who did not know much just the same”.

The sessions were described as “very organised and well structured”. The method made one student “more eager to go as previously I did not like netball”. A newcomer to the game who found playing small-sided games in temperatures of 28 C exhausting attributed the enjoyment of the session to the fact that “the teacher allowed us to rest at any time if we felt that we were really tired or not feeling well”. Another participant who had played competitive netball for U-15 at county level in England stated that the effect of the teaching method generated an “enthusiastic attitude” before the lesson started and “this attitude was sustained throughout the lessons by the teaching method”.

While the advanced students seem to have preferred to play the game throughout the session, one complete beginner for netball (male student) stated that “the (teaching) method was good for me since I knew nothing about netball yet our teacher explained in a clear and simple way what we had to do in the particular practical session”. This also led to a positive effect on the students who felt that “the method included an explanation of rules and techniques, I felt confident during the session”.

Some students cited specific small sided activities such as “when we gathered around the shooting pole and scored as many points as possible” as an enjoyable experience during the sessions. Most participants enjoyed the fact that “they were a small group and everybody talked to each other”. The good relation between the students was something all participants liked. One participant also noted that “I liked and appreciated the fact that everyone present could take part in all activities”. Most of the students commented on the teacher’s input as a source of liking the sessions, something that did not occur with the other classes. One student stated “the teacher had taken great interest in all the pupils and taught the subject in an enjoyable way”. Another student liked the use of equipment such as bibs and netball balls while another one disliked the fact that there were “too many girls compared to boys” in class, another disliked playing in the sun, a couple found the session too long (1 hour 15 minutes) and the entire sessions (five hours) too short to learn the sport well. Quite a few participants disliked being video-filmed. All the participants in this class rated themselves as having improved their knowledge over time and in fact they all showed learning gains on both modes of assessment.

### ***The assessment***

The questions of the W.P. were found to require “too much detail, especially for beginners” yet the questions were described as clear and the time allocated was fair and adequate. The students of one of the two classes described these questions as more “difficult” in comparison to the V.P. One student found the questions that had to be answered with the use of a diagram as “too difficult” while another two subjects found that answering with the use of a diagram “helped a lot” and that it was “fun”. One student felt that open-ended questions are not appropriate for PE and that multiple choice questions, where one just ticks the answers are better. The V.P. was found to be “more interesting” and quite a few students acknowledged that it really helped them “refresh” and “visualise” the rules and techniques that they had done in the sessions. The video clips were found to be “extremely helpful” in “hinting” the answer of the questions in some cases, especially the questions that had to be answered with the use of a diagram. One respondent stated that “I could answer some questions much better than when there were no video clips”. Nevertheless some participants found the video clips playing “too fast” to be of any use though. A few others suggested that providing “more time to answer the questions between one clip and the other” is better. The majority of the participants regarded the frequency of video viewing as adequate and one suggested viewing the clips twice at the end of the session too. It is appropriate to note that these participants were not shown any video clips during their lessons.

Most of the participants in this group favoured the V.P. as “the viewing make you remember more what you learnt during the sessions”. A couple of students found the video clips to cause doubt and confusion about things they knew. The idea of oral assessments was not found appropriate by the majority of the participants in this group. One respondent found it easier to “concentrate when I write than when I discuss”, however one participant thought that it is “easier to discuss and mime than to describe on paper”. Some participants expressed their views against the idea of written assessments for sports activities and suggesting practical assessments or none at all instead.

### ***5.9.5 Physical Education Coursework: Netball (12 participants)***

#### ***The sessions***

The subjects in this class found the teaching method “effective and enjoyable” and some stated that it changed their attitude towards PE in a positive way such that they attended the session with a lot of enthusiasm. The handouts were seen as “very helpful to learn and understand the sport” by most participants and there wasn’t any hostility towards the use of handouts as resulted from the feedback of the physical education coursework: athletics class. One participant enjoyed

the fact that the teacher was taking part in the session. The most enjoyable experiences cited in these sessions were the application of theory to practice and “learning how to play a new sport” which was the case for quite a few students in this class, in particular males. Nevertheless a couple of students disliked the sessions because they did not have a choice of activities and they preferred more “physical contact” sport activities. All the participants in this class rated themselves as having improved over time, as was shown by their learning gains scores.

### ***The assessment***

The respondents described the questions of the W.P. as “clear and precise” however some found them difficult to answer. One participant felt that there wasn’t enough time allocated to this paper. The V.P. was found very helpful as it facilitated “understanding more”. One candidate found this paper very interactive as opposed to the “stressful” written paper. Another respondent did not find the video clips as clear as the questions of the W.P. The repetition of the video clips was also found useful by most respondents as again, it “helps with understanding”. On the other hand some found the repetition of no use. One respondent found the video clips too fast. The majority of the participants of this class preferred the V.P. as it helped with understanding the questions. One must observe that these participants were not shown any video clips during their lessons. The idea of an oral assessment was not met with a lot of enthusiasm, however, some felt that it was better than a written assessment. One participant felt that there should not be examinations as it was thought that “written work has nothing to do with sport”.

### **5.9.6 Sport Studies: Netball (16 participants)**

#### ***The sessions***

These sessions were class-based however students were encouraged to attend the practical sessions held during the school organised activities, and those who were interested in netball did. This certainly reduced the hostility to the feeling that the subject was only theory and it was also evident in the more constructive feedback given by the subjects in the Sport Studies netball class, in comparison to athletics. The teaching method was found “interesting” by most students and the effects generated by the method included comments such as “you learn more than just a practical session” and “learn more particular details”. Others stated that they liked netball more. The handouts were also found very relevant and very informative and most students stated that they read them and “revised them before playing netball”. The video clips were found relevant and enjoyable by most students together with the discussions that went with them. The fact that some video clips showed techniques and rules “step by step in slow motion” was found to be very relevant. The written exercises were also found relevant however one subject disliked “having to concentrate on difficult questions” while another

disliked “having to study”. Participants enjoyed working in groups in class. One participant disliked the sessions because there were no practical sessions organised in the gym.

### ***The assessment***

The respondents of this class found questions of the W.P. “very clear”, relevant to the activity, and of moderate difficulty. The assessment was found very relevant to “what we learnt during the course” and the use of diagrams was found to be a very good idea. The V.P. was however “easier” as the video clips “gave an idea of the answers” and it was easier to understand. Some felt confused with the video clips while another respondent was disappointed that “the answer could not be found in the video clip”. The frequency of repetition of the video clips was appreciated and found useful by the majority of the participants and the V.P. was the more preferred mode of assessment. The idea of oral assessments was regarded as “good” by quite a few of the respondents, while some felt that there shouldn’t be oral exams.

### **5.10 Summary**

This chapter set about to indicate the impact of the modes of teaching and assessment of the content and cognitive components of two physical activities, athletics and netball. The results discussed in this chapter refer to the two modes of assessments (W.P. and V.P.) for each of the physical activities, the experimental teaching conditions, the gender, attendance and the subjects’ participation in physical activities. The subjects who were engaged in the six different groups in the study found the three teaching modes valid and they all showed a preference for the video based written paper irrespective of whether videos were used or not during their teaching sessions.

The results of the experimental teaching conditions using CAFIAS (study 1) will be discussed in the following chapter. The analysis of these results will be synthesised together with those of the experimental modes of assessment discussed in this chapter in chapter 7.

## CHAPTER 6

### DISCUSSION AND ANALYSIS OF RESULTS OF THE EXPERIMENTAL MODES OF TEACHING

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#### 6.1 Introduction

The primary concern of this study was to describe the teacher and pupils behaviours that occurred in the experimental teaching units (ETUs) with reference to the three experimental teaching conditions, the physical activities and their impact on the presentation of the content. The three experimental teaching conditions were Physical Education (practice-based sessions), Physical Education Coursework (practice-based sessions and handout) and Sport Studies (class-based sessions). These conditions were used for netball and athletics.

The results of the six ETUs support the view that there were differences between teacher and students' behaviours, interactions and parameters for the teaching conditions namely, practice-based (ETUs 1 and 2) and class-based (ETU 3) sessions albeit not statistically significant. Variances in behaviours, interactions and parameters also emerged from the nature of the physical activities, i.e. power optimisation (athletics) and coincidence, anticipation and avoidance (team game- netball), often in relation to the teaching conditions.

#### 6.2 Experimental teaching conditions

The teacher and student behaviours for the experimental teaching conditions were different for the class-based sessions (A3, N3) and the practical performance based sessions (A1, N1, A2, N2) for six teacher behaviours and three student behaviours from a total of twenty CAFIAS behaviour categories. The teacher behaviours were; acceptance and use of students' verbal ideas (category 3), use of verbal questions (category 4), time spent on giving verbal information and lecturing (category 5), demonstrations of activities (giving non-verbal information) (category 15) and giving directions (categories 6-16). The student behaviours were; student verbal interpretative behaviour (category 8\), student non-verbal interpretative behaviour (category 18\)) and student non-verbal initiative behaviour (category 19). These behaviours, will be discussed in the following section together with the relevant parameters.

The acceptance and use of students' verbal ideas (category 3) was higher in the class-based sessions; A3, (6.17%) and N3 (11.38%). This can be explained by the fact that class-based sessions allowed for more verbal exchange of communication and the students had more opportunities to verbalise their ideas. The substantially higher percentage of accepted ideas in the netball class could be further explained by the fact that half of this class had previous experience

of the netball game and other sports activities, and the majority of the remainder had participated in other sports activities. In the athletics class only one student had previous experience of athletics while the rest of the class had experience of other activities but not athletics. Thus, students in the netball class were more informed about the game and were in a favourable position to offer ideas in the first place.

The use of verbal questions (category 4), as expected, was relatively higher in the class-based sessions (N3 (5.07%) and A3 (5.88%) as these classes lend themselves to more opportunities of verbal exchange. There was very little use of questioning in the practice-based classes (A1 (1.02%), A2 (0.98%), N1 (2.31%) and N2 (0.80%)). The practice and handout classes for both athletics (A2) and netball (N2) got the least questions. The amount of the percentage time on “questions” used in the practice-based classes was an unexpected result, as the sessions were practically the same. This could be explained by the fact that the teacher “unconsciously” did not probe with questioning during the lesson to leave time for the handout presentation and discussion at the end. Another explanation could be that the teacher believed that going through the handout will answer most questions, and the class was asked if they had any questions at the end, anyway. Questioning was used to monitor the comprehension of what had been presented before moving to something else, to have students summarising main points in their own words and to link the new to the familiar. Other questions used during class-based sessions as part of the written worksheets were also included in this category.

Rosenshine and Stevens (1986) summarised components on presenting information clearly to learners in classroom research and identified “questioning” as a quality of effective teaching presentation. It is evident that the class-based PE lessons allowed for this teaching quality to emerge more than practice-based sessions. Questions put across to students in practice-based sessions were part of a problem solving “teaching strategy”. For example, for teaching the positioning of runners on a lane using the upsweep technique, the teacher used a question that was followed by groupwork:

Episode from the practice-based class

*Teacher: If the first runner starts with the baton in the right hand, (teacher stands in lane with the baton in the right hand while the groups are watching from the sides) on which side of the lane is positioning more efficient and why?*

*Student: Left side so that the right hand holding the baton is in the middle of the lane and unobstructed.*

*Teacher: Right. And the baton needs to be passed to the next runner. Get the other three runners organised in the lane such that the baton travels in a line in the middle of the lane. (Students working in groups of four over a distance of 4m. Teacher goes around groups listening to group discussions. After about two minutes the groups were stopped).*

*Teacher: Now, finish what you are doing. ...Let us have each group demonstrating their plan for passing the baton efficiently. The other groups are required to observe and to give comments about the efficiency of the plan”*

In the class-based session, a series of questions were asked to create the same learning opportunity.

Episode from the class-based sessions

*Teacher: How many runners take part in a relay race?*

*Student: four*

*Teacher: What is this piece of equipment (shows relay baton) that is used in a relay race called?*

*Student: Stick*

*Teacher: Stick is acceptable. It is also called baton. And the major aim in a relay race, for example the 4 by 100-meter relay race, is for the four runners to pass the baton along the 400m as efficiently as possible. Now, if the first runner starts with the baton in the right hand, (teacher holds the baton in the right hand, and turns, giving back to class) on which side of the lane is positioning of this runner more efficient? I would like you to have a look at this short video clip before you decide on your answer. (Classes watches a video clip of a runner starting from a crouch position and a baton exchange for the upsweep technique in slow motion)*

*Student: On the left side.*

*Teacher: Why is it more efficient?*

*Student: The baton is on the free side of the lane.*

*Teacher: Good. On which side of the lane was the second runner positioned and in which hand did he receive the baton. Let us watch the video clip again. (Classes watches video clip)*

*Student: The baton was received in the left hand and the runner was very close to the right line of the lane.*

*Teacher: Would you call that efficient?*

*Student: Yes, the baton did not drop*

*Teacher: Good. It did not drop and it was passed quickly because the runners created an unobstructed path for the baton. Now we will watch the four runners in action and I would like you to observe the sides of the lane where these runners are positioned and the hand in which they receive the baton. Also note the side of the lane in which they run...Let us note down what you need to look for...."*

Thus, the use of questioning was higher in the class-based sessions as a result of the structure of the teaching strategies adopted by the teacher. It must be noted that it was the same teacher teaching in both classes. From the above episodes, there is evidence that the source of the teaching content (runners in a relay race) was similar, however, the task presentation was different. In the practice-based session students were engaged in organising, practising, discussing, demonstrating and evaluating a plan for positioning the runners. In the class-based session the students were required to observe, analyse and evaluate the demonstration of the runners on the video clip. Thus, the psychomotor and cognitive skills involved in the teaching processes were different and were shaped by the classroom environment. Rink (1994) observed that task presentation of motor tasks in pedagogy is effected by the complexity of the instructional setting (progressions over lessons and years) and the multidimensional nature of goals (cognitive, psychomotor and affective outcomes), as well as by the variability in learner styles, ability and motivation to learn.

Teacher clarity of presentation of information was one of the first effective teacher variables identified by early research on teaching (Brophy and Good, 1986), however, that research focused on investigation of teacher discourse looking for evidence of lack of clarity, discontinuity and use of utterances such as "uh" (Rink, 1994). Several studies in PE have begun to investigate

the dimensions of task presentation in the practical setting (Kwak, 1993; Graham *et al.*, 1993). Kwak (1993) concluded that verbal explanation with full demonstrations, summary cues and verbal/visual rehearsal resulted in better processes of characteristics of a skill and the subjects remembered more critical information about the skill than subjects who were given full verbal explanation and partial demonstration or full demonstration only. Graham *et al.* (1993), in a study on investigating teaching a unit of badminton in a secondary school over a six week period identified eight characteristics of effective task presentation. These were; making instruction explicit, emphasising the usefulness of the content being presented, structuring new content, signalling students' attention, summarising and repeating information, checking for understanding, creating a productive climate for learning, and presenting accountability measures. It is evident that these studies did not consider the actual time spent on task presentation as CAFIAS does. While studies describing the holistic concept of task presentation are important, an extension of such work to investigate the relationship of the individual content-cognitive components of different task presentations to student learning is appropriate. This extension of the impact of task presentation on student learning measured through a formal assessment will be further discussed in the next chapter.

The time spent on giving verbal information and lecturing (category 5) was also higher in the class-based ETUs (N3 (55.03%) and A3 (60.19%)) in comparison to the practice-based sessions (A1 (45.84%), A2 (41.31%), N1 (40.96%) and N2 (39.55%)). It is also evident that the practice and handout classes for both athletics (A2) and netball (N2) got less percentage time allocated to giving information/lecturing. The demonstrations of activities categorised as giving non-verbal information (category 15) were expected to be similar in the practice-based sessions (A1, N1, A2 and N2), however, there were more non-verbal demonstrations in the netball practice-based class (N1 (10.34%)) than in the practice-based class with a handout (N2 (5.68%)). In athletics, both practice-based classes experienced a very similar amount of percentage time on demonstrations (A1 (8.32%) and A2 (8.42%)). As expected, the class-based sessions were lower on the non-verbal methods of giving information (N3 (2.12%) and A3 (2.83%)). The findings of this study support the notions that there are differences between time spent on giving information (lecturing, demonstrating) between class-based and practice-based sessions. Class based sessions got more verbal input while practice-based sessions got more non-verbal demonstrations.

CAFIAS parameters such as Total Teacher Contribution (TTC) and Total Teacher use of Questioning (TTQR) and Total use of Acceptance and Praise (TTAPR) was higher for the class-based ETUs (A3, N3) than it was for the practice-based classes (A1, N1, A2, and N2). The environment as a teaching agent was higher in the class-based ETUs (A3, N3) as the teacher used

video clips and handouts during the lessons. The Content Emphasis: Teacher Input (CETI) was higher in the class-based sessions (A3, (0.82) and N3 (0.75), where the teacher was the predominant teaching agent. This finding confirms the finding of Nygaard (1971, 1975) that teacher input approximates 80%.

RT-PE has been forced to consider differences between content that is appropriately taught directly and content for which there were no clearly defined procedures to be learned and taught such as problem solving strategies towards learning (Rink, 1994). Given the nature of the cognitive and psychomotor aims of assessed course in PE, involving a variety of cognitive skills such as knowledge of rules, tactics and techniques, and their application, evaluation and synthesis, the distinction advocated by Rink (1994) becomes very subjective to identify. Meanwhile, alternative strategies to teaching PE such as games for understanding (Bunker and Thorpe, 1982), and the inner game (Madden and McGown, 1989), where there are no clearly defined procedures have been acknowledged as effective as direct instruction (Rink *et al.*, 1990). The primary role of the teacher is to organise and structure the content, an ability referred to as organisation of pedagogical knowledge, and is considered as a separate ability from subject content knowledge (Shulman, 1987).

The instances of giving directions (categories 6-16) were higher for the practice-based ETUs (A1 (5.33%, 1.87%), A2 (6.03%, 1.63%), N1 (4.42%, 2.22%) and N2 (5.61%, 2.75%)) than for class-based sessions. This means that a considerable amount of lesson time was spent on getting the class organised in the practical settings. This time was inevitably taken from possibly more cognitively worthwhile activities that were inherent of the class-based sessions, such as student questioning for checking understanding and cognitive engagement time.

The predominant teacher behaviours in the practice-based ETUs were lecturing (categories 5-15) and direction giving (categories 6-16). This result also emerged from the study by Cheffers and Mancini (1978), however the current study confirms this finding for practice-based sessions only. The predominant teacher behaviours in the class-based ETUs were lecturing (categories 5-15), acceptance and use of students' ideas (category 3) and asking questions (category 4). The emergence of different predominant teacher behaviour categories for the class and practice-based lessons in PE lessons leads one to further probe into the impact that such behaviours have on student behaviours and student learning.

It must be observed that the most occurring student behaviours in the class-based ETUs were significantly different in variety and quantity from the behaviours reported for the practice-based ETUs. Student interpretative verbal behaviour (category 8\), was much higher in the

class-based sessions (A3 (5.08%) and N3 (6.26%)) in comparison to the practice-based classes. This behaviour was comparable to student interpretative non-verbal behaviour (category 18\), (A3 (10.33%) and N3 (6.97%)). These findings imply that students in the class-based sessions were involved in both verbal and non-verbal interpretative activities, with more non-verbal activities assigned to the athletics class. Student initiative verbal behaviour (category 9) was higher for netball N3 (7.42%) than for athletics A3 (0.61%), showing that more discussions were started by students during the team game class-based sessions.

The most prevalent student behaviour in the practice-based sessions was Student non-verbal interpretative behaviour (category 18\). As expected, these were higher in the practice-based sessions (A1 (17.12), A2 (12.36), N1 (24.41%) and N2 (24.60%)) as students were motor engaged in activities. The subject matter taught was reported as one of the strongest variables affecting the time spent in motor engagement in PE classes (Piéron and Cheffers, 1988). The findings of this study support this claim since the netball (game type activity) practice-based ETUs (N2, N2) resulted in higher Student non-verbal interpretative behaviours (category 18\) in comparison to athletics (athletic type activity) ETUs. Nevertheless, in the class-based ETUs, student interpretative non-verbal behaviour (category 18\), also occurred as students were engaged in writing and thinking activities in the classroom (A3 (10.33%) and N3 (6.97%)). The amount of percentage time spent by students on interpretative behaviour is strikingly low, however this is in line with the findings of other studies who reported a maximum of 30% as the upper limit of movement activities (Piéron and Haan, 1980). Student engagement time measured by ALT-PE was lower, amounting to 20% and sometimes 10% (Metzler, 1979, Shute et al., (1982)). These differences do not imply that students' quality of experience of one physical activity is superior over another.

Student behaviours such as Total Student Contribution (TSC) and Total Student Interpretation (TSIR) were higher for the practice-based classes (A1, N1, A2, and N2). Total Student Initiated-Teacher Suggested (TSITSR), was higher for the class-based sessions (A3, N3) as students spent less time responding to predictable responses such as responses “not requiring thinking beyond the comprehension phase” (Cheffers *et al.*, 1980, pg. 23), and following directions (categories 8, 18). The Verbal Emphasis (VE) was highest in the class-based ETUs (A3, N3) as there was more verbal communication by the teacher and the students in class. In contrast, the Non-verbal Emphasis (NVE) was highest in the practice-based ETUs (A1, N1, A2, N2). Students in these classes spent more time engaged in following directions (category 18) and being academically motor engaged (category 18\). Student as teaching agents: Other Students as Teachers (ST) was higher in the practice-based classes (A1, N1, A2, and N2) as students were regularly involved in giving demonstrations of activities amongst themselves or together with the teacher.

### 6.3 Physical Activities: Netball and Athletics

Some of the teacher and student behaviours for the physical activities were different for the netball (N1, N2 and N3) and athletics (A1, A2 and A3) classes, often in conjunction with a specific experimental teaching condition. Differences were observed for three teacher behaviours and four student behaviours from a total of twenty CAFIAS behaviour categories. The teacher behaviours were: time spent on giving verbal information and lecturing (category 5), and giving directions (categories 6-16). The student behaviours were; student verbal predictable behaviour (category 8), student verbal interpretative behaviour (category 8\), student non-verbal interpretative behaviour (category 18\)) and student verbal initiative behaviour (category 9). These behaviours will be discussed in the following section together with the relevant parameters.

The time spent on giving verbal information and lecturing (category 5) in the three athletics ETUs (A1 (45.84%), A2 (41.31%) and A3 (60.19%)), was higher than the percentage time spent during each parallel ETU in the netball classes (N1 (40.96%), N2 (39.55%) and N3 (55.03%)). When the two physical activities were compared, it was evident that the three athletics classes got more information giving time than the corresponding netball classes. Consequently Total Teacher Contribution (TTC) was also higher for the athletics classes. The teacher as a teaching agent: Teacher as Teacher (TT), was found similar across all six ETUs, however it was slightly higher in each case for all three athletics ETUs (A1, A2, and A3). Why this pattern emerged is not clear, however, it must be noted that few studies have looked at the teacher and student behaviours across different physical activities in secondary school PE activities. The study by Lombardo and Cheffers, (1983) on four elementary school teachers involved in lessons for classes of children from Kindergarten to grade 6, identified significant variability of more than eighty percent of the CAFIAS behaviours and parameters for specific content of physical activities (team sports, movement education, self testing and miscellaneous activities). Piéron and Cheffers, (1988) have since reported that the content taught was reported as one of the strongest variables affecting the teacher and student engagement time in PE classes. Research on classroom practices in PE has focused on comparing different approaches to teaching the same physical activity e.g. hockey (Turner and Martinek, 1992;) badminton (Rink *et al.*, 1990), tennis (Metzler, 1986; Kerns, 1989; McPherson and French, 1991) and volleyball (Rink *et al.*, 1986). While these studies are of pedagogical reference, the requirement of GCSE PE courses at secondary level to offer 4-5 physical activities from different areas/families of activities imply that research describing and quantifying teaching strategies needs to be extended to this development.

The time the teacher spent on giving directions (categories 6-16) was higher in the athletics classes (A1 (5.33%, 1.87%), A2 (6.03%, 1.63%) and A3 ( 2.78%, 0.02%)); than for the netball

classes, with the exception of the practice and handout based classes (A2, N2), as more time was spent on giving directions during the netball class. In the athletics practice-based classes students spent more time getting organised for practices ((category 18) - (A1 (11.25%) and A2 (11.43%)) than in the netball classes (N1 (6.01%) and N2 (7.35%)). When this amount of time is added to the amount of time the teacher spent on getting the class organised (6-16), it is evident that the athletics practice-based classes required more classroom management time. This was mainly due to the nature of the activities. For example getting the athletics equipment and the students organised for sprints, relays and the throwing skill required more time than getting students moving from one small sided game to another in netball. Also, the throwing activity required getting the class organised for throwing and retrieving equipment when directed by the teacher as a safety precaution. This inevitably increased the amount of instances when the teacher directed the class.

The student verbal interpretative behaviour (category 8\ ) was higher for the netball classes (N1 (2.05%), N2 (0.65%) and N3 (6.26%)) in comparison to the athletics classes (A1 (0.37%), A2 (0.03%) and A3 (5.08%)) and consequently the Total Student Contribution (TSC) was also higher for the netball classes. This implied that students in the netball class spent more time engaged in verbal discussions on the subject content than students in the athletics class. It must be observed though, that the amount of time the teacher spent on questioning was higher for the athletics classes (A2 (0.98%) and A3 (5.88%)) in comparison to the netball classes (N2 (0.80%) and N3 (5.07%)). This result showed that a higher amount of teacher questioning did not yield more verbal contributions from the students.

Student non-verbal interpretative behaviour (category 18\ ) was higher in the netball practice-based sessions (N1 (24.41%), N2 (24.60%)) in relation to athletics practice-based classes (A1 (17.12%), A2 (12.36%)). This indicated that students in the netball classes experienced more student motor engagement time. On the other hand, in the case of the class-based ETUs, Student interpretative non-verbal behaviour (category 18\ ) was higher for athletics (A3 (10.33%)) in comparison to netball (N3 (6.97%)). This suggests that more writing and thinking activities took place in the athletics class in comparison to the netball class. Total Student Dependant (TSDR) was high and similar across all ETUs with the exception of the class-based netball ETU (N3- 67%), implying that students in the netball class took more verbal and non-verbal initiatives (category 9, N3 (7.42%); category 19, N3 (0.03%)). Consequently, the parameter Total Student Initiated, Student Suggested (TSISSR) was also low and similar across all ETUs with the exception of the class-based netball ETU (N3) as students took the initiative to discuss issues expanding the aim and content of the lesson.

The Content Emphasis: Student Input (CESI) was high in the Netball practice-based ETUs (N1 (0.27), N2 (0.25)) and lower in the netball class-based ETU (N3, (0.13)) and all athletics ETUs (A1, (0.18), A2, (0.13) and A3, (0.15)), suggesting that student demonstrations were more popular in netball than in athletics. The results of this study indicate that student input has been found to be higher than the 10% found in the study of Nygaard (1971, 1975), with a marked increase in input from students especially in the netball practice-based lessons.

Time spent by the teacher in silence waiting for the class to turn up (20t-20t) was frequent in A2 (9.3%), A3 (3.1) and N2 (7.5%). The reasons why three classes (A2, A3 and N2) in the same school took so much time to come to class could be explained because of the scheduling of lessons in relation to breaks and the distance students had to walk to get to the gymnasium. Class A2 was time-tabled immediately after another lesson, (11.45am-12.30pm) and students had to walk to the gymnasium, while for class A3, the teacher always arrived a few minutes late for the lesson due to travelling (by car together with the camera persons and equipment) from the gymnasium to the main classrooms block. Class N2 was scheduled right after the mid-morning break (10.45 am) and the students seem to have taken a lingering walk from the canteen at one end of the school complex to the gym, at the other far end.

The actual number of filmed sessions did not turn out to be congruent with scheduled hours of the ETUs i.e. five hours for netball and six hours for athletics. The three-second-interval signal recorded on tape was checked before the coding started and the timing was correct. These discrepancies could be mainly attributed to the scheduling of times of session and school policies regarding times for ending sessions, changing and showering. For example the time taken by the researcher and the video persons to travel from the gym to the class when lessons were scheduled consecutively after each other i.e. N2 (10.45 am – 11.45 am) - N3 (11.45 am – 12.30 pm), was inevitably chopped off actual lesson time. For A1 the session was scheduled right after the mid-day break and it was often the case that equipment of school organised activities was not cleared on time for the video cameras to be put up to start filming exactly on the scheduled starting time of the sessions. For this class (A1), the school policy for physical education provided for the last lesson of each day to be terminated 10-15 minutes before (i.e. 2.05 pm instead of 2.15 pm) to allow students enough time to get changed and walk from the gym at one end of the school, to the school gates to be on time for school transport. Filming of these last 10-15 minutes was not done. In the second A1 class, given by the volunteer teacher, the hour lesson time designated for the class was in addition to the 15 minutes allowed before and after the session (half hour in total) for changing and showering, and actual time was recorded. For N1, the school policy for changing and showering required dismissal of class 15 minutes before the scheduled termination, and this time was not recorded either.

The actual lesson time of A2, A3, N2 and N3 was substantially reduced because the school operated a different time policy for lessons: i.e. the first two lessons of certain week days were of one hour duration each and the remaining classes for the day were of 45 minutes each. Trying to negotiate an additional 15 minutes with the teacher of the next class or taking up break time was not always feasible or welcome by the students. These situations were not anticipated and it was thought appropriate to increase the number of sessions of some ETUs, in particular the 45 minutes session to allow for experimental condition time to be delivered. This would have meant having one or two sessions and the post-tests extended till after the Christmas vacation. However, it was argued that this break would have possibly effected the retention of information and since all classes had their post-tests administered a week after treatment, it was decided to keep the experimental conditions as similar as possible to all classes. Increasing the number of sessions was also partial tempering with the “real” time and situation of life in schools and it was decided to stay with the actual development of the ETUs.

#### **6.4 CAFIAS Interactions**

Most interactions varied very little across the ETUs, and this was in relation to both teaching conditions and the physical activities. For all six ETUs the highest occurring interaction was extended teacher verbal information given during the sessions (5t-5t). This was closely followed by extended student non-verbal interpretative behaviour (18s-18s), referring to instances when the students were actively motor/cognitively engaged. This behaviour ranked between second and fourth in all ETUs with the highest percentage of frequency of interactions recorded in N2 (18.5%), followed by N1 (17.7%), A1 (12.2%), A2 (8.4%), A3 (8.1%) and N3 (5.0%).

Other interactions were specific to teaching conditions. For example the environment as a teaching agent (5e-5e) ranked second highest in the class-based ETUs (A3 (14.4%) and N3 (11.9%)) and relatively lower in the practice and handout classes (A2 (5.0%) and N2 (2.4%)). The use of the environment as a teaching agent was not frequent in the practice-based classes A1 and N1. The frequent use of teacher questioning followed by extensive information giving (4t-5t) was recorded as a pattern in the class-based sessions (N3 (2.0%) and A3 (2.9%)). Student predictable response (18s-18s) where students were getting organised for activities was a frequent interaction pattern in the practice-based classes A1 (7.0%), A2 (7.0%) and N1 (3.2%) and N2(4.5%).

There were some interactions that were found to be particular to the physical activities, and teaching conditions. For example non-verbal demonstrations of activities followed by verbal

information giving by the teacher ((15t-5t) - (7.2%)) and vice versa ((5t-15t) - (6.4%)) were specific to the athletics practice class (A1). Verbal information giving followed by non-verbal demonstrations of activities ((5t-15t)- (7.4%)) was found to be frequent in athletics practice and handout class (A2). This implies that there were fewer demonstrations of activities in A2. This pattern also emerged in the netball practice-based classes. The use of non-verbal demonstration of activities (15t-15t) was frequent in the netball practice class (N1 (6.6%)) and so was the involvement of students in the demonstration of activities together with the teacher (N1 (15s-15t)- (3.3%)) and teacher information giving followed by demonstration by the students (N1 (5t-15s)- (3.00%)). These patterns were not frequent in the netball practice and handout class (N2), where the teacher was demonstrating and giving information (N2 (15t-5t)- (4.0%); (5t-15t) – (3.4%)). The use of students for the purpose of demonstration of activities was not frequent in athletics.

The student verbal interpretative behaviour (8s-8s) – (5.00%) and student verbal initiated behaviour (9s-9s)- (2.9%) were also frequent patterns in the netball class-based ETU (N3). These patterns were not found frequent in athletics.

## 6.5 Summary

The use of CAFIAS for analysing the six experimental teaching units has been useful in identifying the differences and similarities in teacher and student behaviours for both the physical activities and the three experimental teaching conditions. This analysis has identified differences in teacher and student behaviours due to the experimental teaching conditions namely that class-based sessions got more teacher acceptance of student suggested ideas, lecturing and student questioning time and students' verbal involvement in the lesson. In comparison, the teacher spends more time on demonstrating activities and giving directions in the practice-based sessions while students spent more time non-verbally motor/cognitive engaged. The predominant teacher behaviours for the class-based sessions included lecturing, questioning and acceptance of student ideas as opposed to lecturing and giving directions, as emerged from the practice-based classes.

The main differences in teacher and student behaviours that emerged as a result of the physical activities were a higher percentage time for lecturing, questioning, classroom management time, giving directions and writing and thinking activities for athletics. Netball resulted in higher percentage time spent on motor engagement and verbal input from the students. The outcomes of this study confirm some of the findings found in previous investigations on physical activities in the practical setting (Cheffers and Mancini, 1978), however the students input in this study was higher than the 10% found by Nygaard (1971, 1975), in particular in the team game practice-based lessons. Athletics, as a power optimisation activity required more lecturing, questioning

(except for the practice only classes) and management time than the team game classes, however, students' verbal contribution to the lessons was higher in the netball team game classes. In the next chapter, the content and cognitive components of the six ETUs will be discussed with reference to the physical activities and the experimental teaching conditions.

## CHAPTER 7

### DISCUSSION AND ANALYSIS OF RESULTS OF THE EXPERIMENTAL MODES OF ASSESSMENT

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#### 7.1 Introduction

The following chapter presents a detailed examination of the impact of the two experimental modes of assessments, namely the W.P. and the V.P. on the content (techniques, tactics and rules) and cognitive (knowledge and comprehension, application and analysis, and synthesis and evaluation) domains of two curricular areas of GCSE and 'A' level PE. These activities were athletic type (power optimisation activities (PO) e.g. athletics, swimming) and game type (coincidence, anticipation and avoidance activities (CCA) e.g. ball games: netball; racquet games: tennis; combat games: judo; target games: golf; net/wall; striking/fielding/target; and invasion).

The Knowledge Structures (K-S) model (Vickers, 1990) supports the notion of stratification of physical activity content knowledge as a vehicle for delivering both declarative and procedural knowledge. Declarative knowledge can be equated to the content domains in this study. However, the K-S model does not offer a clear classification of procedural domains other than "decision making in sports", which corresponds to the application cognitive component. In this sense the K-S model is more geared towards the "performance" of physical activity and does not fully acknowledge the analysis and evaluation cognitive domains. Another aspect which the K-S model has not sufficiently developed in order to meet the requirements of examined physical activities (GCSEs and 'A Level) is assessment. Vickers (1990) puts the idea of "a skills acquisition structure" (pg. 132) as a method of analysing the technique or skill that a teacher needs to assess, analyse or correct. GCSE and 'A' level PE is concerned with more than just techniques. The "games for understanding" (GFU) model (Bunker and Thorpe, 1982; Werner *et al.*, 1996) has contributed to the pedagogic domain of games teaching and emphasised the sequence of integrating tactics, techniques and rules, the content domains of game type activities. The shift has been from techniques to tactics (decision making) (Lee, 1987). The differences between game type activities (Turner and Martinek, 1999) (e.g. badminton and field hockey) has become an area of pedagogic concern, and the influence of the appropriateness of different teaching approaches is not new (Rink, French and Graham, 1996). The GFU model has also vaguely described the "understanding" component in terms of "informed decision making" and has not addressed the issues of assessments of game type activities. Thus, these two models have contributed more to what

and how physical activities are taught and have left the transition from National Curriculum to GCSE and 'A' level PE as a grey area.

The classroom environment was a predominant factor in this study and the use of the "class-based sessions" together with the more traditional practice-based PE classes was somewhat new to RT-PE. The structuring of the classroom environment so that students respond to motor learning with greater appropriate practice (Silverman *et al.*, 1998) and the significant relationship between appropriate practice trials and achievement have been heavily substantiated in the literature (Silverman, 1991, 1993; Buck *et al.*, 1991). However, teachers need to consider student perceptions and also the learning environment because both affect the achievement outcome (Lee, 1997). Sweeting and Rink (1999) suggest that an appropriate environmental design helps students elicit an initial movement pattern and is also a factor in initial achievement outcome. It is observed that when talking about the teaching environment there is still a heavy notion attached to the practical performance component. Nevertheless, the importance for students to be cognitively engaged in their own learning (Harrison *et al.*, 1999) is gaining acceptance. In this regard, British examiners have been recommending class-based sessions for teaching GCSE PE, in addition to practice-based sessions (MEG, 1993), and some teachers used homework for the analysis of performance (Forsyth, 1994).

The teaching environment and the use of assessments in PE resulted in a variety of feedbacks from the students in this study. The practice-based classes and the class-based sessions for both activity types were regarded as acceptable teaching environments by most of the students. The acceptance of Sport Studies being taught in a classroom setting received very encouraging and positive support, which suggests that most students found the experience relevant and enjoyable. In this study, students were strongly encouraged to take part in the "performance" of physical activities offered by the school, in addition to the class-based sessions. It would be interesting to know if those students who commented positively on the impact of the sessions of the class-based environment responded in the affirmative so that they would not have to do physical activity, sweat and shower. These findings are similar to those of Strand and Scantling (1994) who found that 54% of high school students would enrol in a PE course offered as an elective and taught in a classroom setting. This inevitably raises the issue of alternative teaching strategies and resources, namely textbooks, videos, computer-based resources, and so on. The expansion of technology in physical education (Silverman, 1997) has been characterised with four categories of potential problems; have vs. have nots; physical activity (performance) vs. teaching via technology; pedagogic considerations: Is this the best way to teach?; and implications for teacher educators. The use of video and computer as a replacement of a teacher in a practical session needs to be questioned in relation to the purpose of the technology use and whether it will

promote skilled, healthy, enjoyable physical activity. Silverman (1997) has negatively valued using technology for demonstration instead of the teacher, however this generalised statement does not do justice to the different sports activities, some of which are too skilful for the teachers to demonstrate (e.g. Olympic gymnastics). For the purpose of evaluation and analysis, video recordings of performance are a very important source of data for both athletes and the subjects who are assessed on these cognitive domains.

The idea of assessing physical activities through W.P. also received positive acknowledgement from most subjects, with a preference for the V.P. for both types of activities. There were some subjects suggesting that there should not be exams in PE, and this did not come as a surprise, as many individuals view PE as “non-academic” (Graham, 1990), a subject in which the body works and the mind rest. This view is understandable as high school students appreciate the award of grades in PE based on the subjective variables of participation, effort, sportsmanship and attitude (Strand and Scantling, 1994). A second tier of attributes selected by students for determining grades included dressing, attendance and behaviour while the least preferred attributes included homework, written tests, skill tests, fitness tests and potential (Strand and Scantling, 1994).

The following discussion will attempt to expose the links between the modes of assessment and the content and cognitive domains for the purpose of GCSE and ‘A’ level PE and Sport Studies. The focus is on the modes of assessments on which subjects in this study were found to perform better with reference to the content and cognitive domains of the athletic and game type activities. The ANOVA procedure on the post-test scores resulted in a number of statistically significant different results for the two modes of assessment for both types of activities. The MANOVA (repeated measures) analysis provided the details of the statistically significant improvement shown by the various groups over the treatment period. The statistically significant findings that resulted from these two procedures will be discussed and used as evidence to justify the proposals with regards to the suitability of the modes of assessment and teaching in relation to specific content and cognitive domains for each of the two activity types. The statistically significant main effects and interactions that emerged from the data analysis of the experimental teaching conditions, the physical activities, the gender of the subjects, and participation in physical activities, including those outside the school curriculum will also be discussed. These will shed light on whether some of the content and cognitive domains taught using particular teaching conditions are better assessed using particular modes of assessment.

## **7.2 Assessing the content domains**

The content knowledge of physical activities is the focus of “performance proficiency” and performance-related knowledge, a domain of the disciplinary mastery value orientation of the curriculum (Jewett *et al.*, 1995), that is highly valued in PE syllabuses and textbooks, however, Siedentop *et al.* (1994) noted that content knowledge as an objective for teaching PE rated low in priority. On the other hand, on commenting on the content instructional issues of sport programmes, Siedentop *et al.* (1994) concluded that if one considers skill improvement, strategic play and acquisition of knowledge, then many of the class ecologies achieved modest learning gains at best as instruction did not have the intensity (by which they meant students seriously and intensively engaged in learning activities) other than a literal and symbolic sense of “gym was no sweat!”

The content domains of physical activities are often assessed using multiple choice type questions and are often called knowledge tests. These covered content items such as techniques, rules and strategies (volleyball) (Harrison, 1999); knowledge of rules, player positions and terminology (basketball) (French and Thomas, 1987), and a written test on rules, strategies and mechanics (volleyball) (Rink *et al.*, 1986).

It was hypothesised that the content domains of different physical activities would result in statistically significant results when assessed using different modes of assessments. When the two modes of assessments (W.P. and V.P.) of the three content domains (techniques, tactics and rules) were taken into consideration, the scores of some of the content domains resulted in statistically significant results for one or both types of activities. Thus, the findings of this study partially support the hypotheses. The following discussion will identify the content components that were found to provide significantly better results in relation to one or both modes of assessments. Reference will also be made to those variables that contributed to the main effects or interactions leading to these outcomes.

### **7.2.1 Techniques**

In the case of techniques, the experimental teaching conditions and gender resulted in a significant effect on the modes of assessing techniques for athletic type activities only, though the experimental teaching conditions and gender resulted in statistically significant post-test scores for the two modes of assessment for both the athletic and the game type activities. Participation in athletics at extra curricular level also showed up as a significant contributor to post-test scores for the athletic type activity.

In the case of the athletic type activity, the improvement of the scores over the different treatment of the teaching conditions revealed statistically significant differences over the V.P. Further investigation on the rate of improvement of scores over treatment resulted in subjects from the class-based sessions doing significantly better on the technique questions of both papers (W.P. and V.P.) in comparison to the two practice-based classes. This means that subjects in the practice-based classes did not acquire better abilities of knowledge recall, application and evaluation of techniques by simply practising or practising and reading about techniques. Another possible explanation for this result can be attributed to the fact that the practice-based classes did not do any writing activities, and were not trained to communicate their “understanding” about techniques in writing. Since the post-test scores of the two papers (W.P. and V.P.) were not significantly different for the different teaching conditions, one can propose that for athletic type activities, techniques’ questions are better assessed using the V.P. It can also be suggested that teaching techniques in a class-based environment will result in higher scores.

For the game type activity, the improvement of the scores over the treatment period was not found to be statistically significant for any teaching environment for neither mode of assessment. These findings are similar to those of Turner and Martinek (1992), who reported no significant increases for either declarative or procedural knowledge over a six-lesson treatment in field hockey for subjects in technique and tactical oriented teaching groups. Yet, in this study, at post-test, the subjects of the practice-based classes scored significantly higher than those in the class-based session for the techniques questions of the W.P. This implies that in the case of the game type activity, the practice-based class acquired better information of techniques by practising or practising and reading about techniques. One can remark that the practice-based classes did not do any written activities, and were not trained to communicate their knowledge about techniques in writing. This, as one would have expected, did not result in lower scores than those of the subjects of the class-based sessions, who had regular written activities as part of their teaching treatment.

The practice-based class scored higher on the W.P. and the class-based group and the practice and handout group achieved higher scores on the V.P. Thus, a WP on techniques of game type activities will yield significant higher scores with respect to practice-based classes only. One can therefore suggest that teaching techniques of game type activities in a practice-based environment is best assessed using a W.P., whereas a class-based course with the use of video clips, and a practice-based class with the use of handouts will yield higher scores on a V.P.

The contrast between the athletic type and the game type activities for the assessment of techniques that resulted in this study can be related to the differences found in the execution of

techniques for badminton (French *et al.*, 1996) and field hockey (Turner and Martinek, 1999). For badminton (game: net/racquet), subjects from the techniques teaching approach performed better than the tactical group whereas subjects from the tactical treatment in the field hockey (game; invasion) study performed better than the techniques treatment group.

Female subjects scored significantly different than males on the techniques component of the W.P. of the athletic type activity, however, both male and female subjects scored higher on the V.P. This means that in the absence of a V.P., females will do better than males on a W.P. However, the use of a V.P. is likely to yield higher scores for both males and females, narrowing any inequalities that result in discrimination against male subjects as a result of the use of a W.P.

For the game type activity, females improved their score significantly on the techniques questions of the V.P., however, both males and females scored higher on the W.P. It is interesting to observe that the reverse happened in the case of the athletic type activity techniques questions, and the same rationale applies to propose that a W.P. for the techniques component of a game type activity will benefit both males and females.

It is also observed that the interactions of the teaching conditions and the gender were not significant for any activity on any of the two modes of assessment. Thus, one can suggest that a class or practice-based teaching environment will not contribute to statistically significant differences between the score of males and females taking a V.P. for techniques questions of athletic type activities, and an W.P. for the techniques questions of game type activities.

The subjects of the athletic type activity who participated in performance based sessions in athletics before the treatment achieved significantly better results on the techniques component of the W.P., in comparison to those who did not participate at extra curricular level. This suggests that subjects who have a club-level background and/or participate in the activity (athletics/swimming) at extra-curricular level will score higher results on a W.P. One must also observe that these subjects scored slightly lower on the V.P., however, the difference was not significant. Given that the W.P. discriminates in favour of those who can participate at extra-curricular level and that the significance between the two modes of assessment was not significant, one can propose that the use of a V.P. for the techniques component of athletic type activities, will narrow any differences amongst participants who are involved in the activity outside the school and those who are not. However, one must acknowledge that participation at extra-curricular level ought to be encouraged. In the case of the game type activity, there were no statistically significant differences for the techniques component for those who were involved in netball, or other physical activities at extra-curricular level.

### 7.2.2 *Tactics*

The experimental teaching condition emerged as a main effect for the athletic type activity while attendance to all sessions resulted in a significant effect on the modes of assessing tactics for both activities. The experimental teaching conditions resulted in statistically significant post-test scores for the two modes of assessments for both types of activities. Participation in physical activities at extra curricular level also showed up as a significant contributor to post-test scores for the athletic type activity.

For the athletic type activity, subjects in the class-based sessions improved their score over treatment at a significantly higher rate than subjects in the practice-based sessions on the V.P. This means that for the V.P., the practice-based classes did not obtain superior skills of knowledge recall, application and evaluation of tactics through practising or practising and reading about tactics. A possible reason is that maybe while the class-based group received video, verbal and written instruction on tactics, the teacher provided only verbal instruction and demonstration during the practice-based sessions. This result also emerged in the case of the technique questions, for both the W.P. and the V.P.

There also resulted significant differences between the teaching environment on both modes of assessment for the athletic type activities at post-test. In this case, the significant differences were explained because the class-based teaching group scored higher than the practice-based and handout class on both the V.P. and the W.P. However a higher score was recorded for the class-based group for the tactics questions on the V.P. It must be observed that the practice group scored higher on the V.P. than it did on the W.P. for the tactics component too. It was also evident that a class-based approach for teaching also resulted in the highest scores for the V.P., however, this was not significantly different from the score of the practice-based class (Scheffe's test at 0.05 level). This implies that teaching can be exclusive to either a class-based approach or a practice-based approach, however, a combination of practice and class-based sessions will potentially increase the scores of a V.P. One can thus argue that the use of a V.P. for assessing the tactics components of athletic type activities will yield higher scores.

In the case of the game type activity the improvement of the tactics scores from pre-test to post-test were not significant. This result is similar to that of Rink *et al.* (1986) whose subjects' scores improved significantly for rules and mechanics, but not for tactics over a 15-lesson volleyball unit. The improvement of the scores of the three different teaching environments for the tactics questions was not found to be statistically significant for neither mode of assessment. However, the subjects of the practice-based class scored significantly higher than those in the class-based

session for the tactics questions of the W.P. Nevertheless, subjects in the practice and handout class and the class-based group scored higher on the V.P. than they did on the W.P. This case also resulted in the case of the technique scores of game type activities. Thus, a WP on tactics of game type activities will yield significant higher scores with respect to practice-based classes only. One can thus suggest that teaching tactics of game type activities in a practice-based environment is best assessed using a W.P., whereas a class-based course with the use of video clips, and a practice-based class with the use of handouts will yield higher scores on V.P.

Attendance resulted in a significant main effect for the tactics questions of the W.P. of the athletic type activity and the V.P. of the game type activity. In both cases, those who attended all sessions as opposed to missing one session outperformed the others over the treatment period. It is interesting to observe that the effect resulted only for one mode of assessment for each of the two types of activities. This implies that the tactics content component fundamentally requires subjects not to miss classes, or for teachers to do substantial consolidation work when the assessment of tactics is done using a W.P. in the case of athletic type of activities, and when the V.P. is used for assessing tactics of game type activities. Should the alternative modes of assessment be used (i.e. V.P. for athletics and W.P. for game type activities), missing one session will not potentially result in a significant main effect.

The subjects from the athletics group who participated in activities other than athletics prior to the treatment achieved significant better results on the tactics component of the V.P. This suggests that subjects who have a club-level background and/or participate in the activity (athletics) at extra-curricular level will score higher results on a V.P. Thus, when a V.P. is used to assess the tactics domain of athletic type activities, students who are enrolled on extracurricular activities will score significantly higher.

### **7.2.3 Rules**

The experimental teaching conditions resulted in a significant effect on both the modes of assessing rules for athletic type activities. The experimental teaching conditions resulted in statistically significant post-test scores for the two modes of assessment of the athletic type activity and the W.P. of the game type activity. Gender resulted in statistically significant post-test scores for the two modes of assessment of the game type activity. Participation in physical activities at extra curricular level also showed up as a significant contributor to post-test scores for the athletic type activity.

The rules questions of the athletic type activity were effected by the teaching conditions as subjects from the classed based sessions scored significantly higher than the other two groups on

both modes of assessment (W.P. and V.P.). It is observed that the practice and the class-based groups scored lower on the W.P. Thus, one can propose that for athletic type activities, rules questions are better assessed using the V.P. One can also suggest that teaching rules in a class-based environment would result in higher scores. It is observed that for all the athletics content domains, the subjects in this study achieved significant better results through the V.P. Nevertheless, the rules questions of the game type activity resulted in significantly higher post-test scores for the subjects of the practice-based class in comparison to those in the practice-based class with a handout. This result was not expected. However, subjects in the practice and handout class and the class-based group scored higher on the V.P. than they did on the W.P. This result also showed up in the case of scores of the techniques and tactics of game type activities. The improvement of the scores of the three different teaching environments for the rules questions was not statistically significant for neither mode of assessment, however, on post-test scores the W.P. yielded significant higher scores with respect to practice-based classes only. One can thus suggest that teaching the rules content of game type activities in a practice-based environment is best assessed using an W.P., whereas a class-based course with the use of video clips, and a practice-based class with the use of handouts will yield higher scores on a V.P. There was no significant improvement on the rules questions of the game type activity questions. This result is different from that of French and Thomas (1987) who reported significant main effects of the knowledge test, part of which was on rules, and that of Rink *et al.* (1986) whose subjects' scores improved significantly for rules over a 15-lesson volleyball unit.

Female subjects scored significantly different than males on the rules component of both modes of assessment. It is observed that the highest score emerged from the V.P. for both males and females. Thus, one can propose that for game type activities, rules questions are better assessed using the V.P.

Participation in activities other than athletic type also resulted in significant better results for the rules' questions, the rules-evaluation domain of the W.P. and rules-knowledge questions of the V.P. This implies that participation in physical activities at extra-curricular level will potentially contribute to higher scores of rules questions of both modes of assessments. This finding supports the suggestion advocated by French and Thomas (1987), who explained that since adult performers use different cues to make decisions within the context of a physical activity, a foundation of declarative knowledge, such as knowledge on rules, is necessary for development of procedural knowledge, such as evaluation.

### **7.3 Assessing the cognitive domains**

Cognition and decision making was identified as a limited area of RT-PE (Silverman and Skonie, 1997) and as Lee has noted (1991, 1996) research in this area is necessary for understanding how process variables influence achievement and understanding. Thomas *et al.* (1986) argued that a strong base of cognitive knowledge as well as motor skills is necessary for effective performance, however, they add that RT-PE has failed to relate sport-specific knowledge base to sport-skill performance. The examination of the relationship between cognitive skills involved in sport performance and content knowledge is an area on which only a limited number of studies exist (French and Thomas, 1987), however one study concluded that the skill level of subjects (low, medium or high in performance outcomes), was not a factor effecting cognitive outcomes (Rink *et al.*, 1986). Although this has been explained by the possible lack of sensitivity of the test to changes in cognitive learning outcomes, one must note that Rink *et al.* (1986) also revealed that performance was not synonymous with cognitive outcomes either. This finding supports the notion of keeping the practical assessments of cognitive dimensions, such as application and decision making as separate from written-based assessments.

It was hypothesised that the cognitive domains of different physical activities would result in statistically significant results when assessed using different modes of assessments. The assessment of the cognitive domains with the use of the two modes of assessments (W.P. and V.P.) also resulted in statistically significant different results for both types of activities. Thus, the findings of this study partially support the hypothesis. The cognitive components that emerged as significant results in relation to one or both modes of assessments will be discussed in the following sections. Reference will also be made to those variables that contributed to the main effects or interactions leading to these outcomes.

#### ***7.3.1 Knowledge and comprehension (Knowledge)***

For the athletic type activity the experimental teaching conditions resulted in a significant effect on the V.P., while gender emerged as a main effect on the W.P. for assessing the knowledge component. The experimental teaching conditions and gender resulted in statistically significant post-test scores for the two modes of assessment of athletic type activities. Gender, attendance and participation in netball were found to be significantly different on the post-test scores of the V.P. for the game type activity. For the athletic type activity, participation in physical activities at extra curricular level also showed up as a significant contributor to the post-test score of the V.P.

The knowledge questions of the athletic type activity were answered significantly better by the subjects from the classed-based sessions for the V.P. especially in relation to the practice and handout group. This implies that discussing and giving a handout to subjects after a practical

session will not produce the same results as a class-based session for the knowledge component of athletic activity. However, it is observed that there was no main effect on the W.P., which implies that the improvement of knowledge over treatment of different teaching environments will not be significantly different for a W.P. On the other hand, statistically significant differences emerged on the post-test scores of both modes of assessment (W.P. and V.P.). It is observed that the practice and the class-based groups scored higher on the V.P. Thus, one can propose that for athletic type activities, knowledge questions are better assessed using the V.P. One can also suggest that teaching knowledge in a class-based environment would result in higher scores on both modes of assessments.

For the game type activity, the experimental teaching units did not result in significant main effects, and the post-test scores of the knowledge components did not emerge as significantly different either. It was observed that the highest score was acquired by the class-based group on the V.P. ( $m=18.38$ ,  $S.D.=5.38$ ) closely followed by the scores of the practice-based group who achieved the same score on both modes of assessment (W.P.  $m=17.30$   $S.D.=5.61$ ; V.P.  $m=17.30$   $S.D.=4.61$ ), while the practice and handout group scored higher on the V.P. ( $m=16.83$   $S.D.=8.74$ ). Thus one can suggest that with the use of a V.P., all groups are likely to score higher on the knowledge component of game type activities and that the teaching environment will not make a difference.

Female subjects scored significantly different than males on the knowledge component of the W.P. of the athletic type activity; however, there emerged significant differences on the post-test-scores of both modes of assessments. Female subjects scored higher on the V.P. ( $m=17.63$ ,  $S.D.=9.02$ ) in comparison to the W.P. ( $m=16.63$   $S.D.=8.69$ ), however, the differences between these two scores were not significant. Male subjects scored slightly higher on the W.P., however the differences between the post-test scores for the two modes of assessment were not statistically significant either. Since the difference between the scores of a W.P. and V.P. were not found to be statistically significant for both males and females, one can suggest that the use of a V.P. is likely to yield higher scores for the knowledge component of athletic type activities. For the game type activity, females scored higher, and significantly different on the knowledge questions of the V.P., however, both males and females scored higher on the V.P. than they did on the W.P. Thus, one can suggest that the use of a V.P. for the knowledge component of game type activities will result in higher scores for both males and females. It is also observed that the interactions of the teaching conditions and the gender were not significant for any activity on any mode of assessment. Thus, one can suggest that a class or practice-based teaching environment will not contribute to statistically significant differences between the scores of males and females taking a V.P. for the knowledge questions of athletic and game type activities.

These results support the analysis of the Scottish Examining Board (1995), where it emerged that girls did better on the knowledge and understanding questions. It would have been interesting to relate these results to the current state of performance of girls in the United Kingdom. However, results of the various assessments that make up the final grade such as the practical performance coursework, the various areas of content included in the W.Ps. such as sport science (human body in relation to movement), social science (development and organisation of sport) knowledge and physical activities are not readily accessible from the examining boards (Carroll, 1995). Fairley and McGonigal (1996) questioned why PE was one of the very few Standard Grade subjects where boys obtained significantly better results than girls, however Carroll (1995) noted that in 1994, girls who took GCSE and 'A' level in PE did better than boys at higher grades.

For the game type group, participation in netball resulted in significantly higher scores on the knowledge questions when using a V.P. In the case of the athletics groups, participation in activities other than athletic type showed up as a significant better result for the knowledge questions of the V.P. These results are consistent with similar results on game type activities. The findings of French *et al.* (1996) reported transference of knowledge of techniques for a 6-week badminton unit while Turner and Martinek (1999), attributed the acquisition of tactical knowledge of field hockey to the participation of subjects in another invasion game, for example basketball. In the current study it is interesting to note that subjects enrolled on the game type activity did not register any significant main effects from participating in other physical activities, however subjects from the athletic type groups did. It is also interesting to observe that most of the activities in which these subjects participated were game type (football, volleyball and basketball) and there were very few ( $n=3$ ) who participated in athletic type activities such as swimming. These results suggest that transference of knowledge (tactical, technique and rules) from one activity type (e.g. game type) to another (e.g. athletic type) is possible and this area requires further investigation. From these results one can also propose that should the use of a V.P. for the knowledge content of athletic type activities be in use, candidates ought to be encouraged to participate in other physical activities.

### **7.3.2 Application and analysis (Application)**

In the case of the application component of athletic type activities, the experimental teaching conditions resulted in a significant effect on both modes of assessment, while attendance emerged as a main effect on the W.P. The experimental teaching conditions resulted in statistically significant post-test scores for the two modes of assessment of both the athletic and game type activities. Gender resulted in a significant main effect in the case of W.P., while

participation in netball showed up as significant for the V.P. of the game type activity. Gender also showed up as a significant factor for the application post-test scores for the athletic type activity.

The application questions of the athletic type activity were effected by the teaching conditions as subjects from the classed based sessions scored significantly higher than the other two groups on both modes of assessment (W.P. and V.P.). It is observed that the practice and the class-based groups scored higher on the V.P. Thus, given the robustness of the marking scheme one can propose that for athletic type activities, application questions assessed using the V.P. are better to demonstrate what the students have learned. One can also suggested that teaching the applications cognitive domain in a class-based environment would result in higher scores.

In the case of the game type activity, there resulted significant differences in the post-test scores of the application component, with the subjects in the two practice-based groups scoring higher than the class-based groups on the W.P. It was also observed that all groups scored higher on the W.P. This finding can be contrasted to studies on “decision making” in field hockey (Turner, 1996; and Turner and Martinek, 1999), football (Mitchell *et al.*, 1995) and badminton (French *et al.*, 1996). While the hockey studies revealed that the tactical oriented groups made better decisions (application) than the techniques groups, the football study reported that a tactical approach to games teaching enhanced students’ off the ball movement but failed to show any impact for on the ball decision making for either the technique or tactical groups. In the badminton study, there were similar results recorded on decision making for the skills, tactics, and combination treatment groups. The teaching of analysis of techniques of tennis (game; net/racquet) was investigated using a computer based interactive video instruction with video clips (2 sessions) and traditional teaching in the form of a lecture presentations (2 sessions) in addition to practical performance (12 sessions) for each group (Chung, 1992). This study did not report significant differences between the two groups for neither the written knowledge nor the video based skill analysis test. These findings, although inconclusive, suggest that a practice-based teaching environment will enhance the decision making and application component of game type activities. As far as the mode of assessment is concerned, one can propose that for game type activities, application questions are better assessed using the W.P., as it yields higher scores. One can also suggest that teaching the applications cognitive domain in a practice-based environment would result in higher scores for game type activities.

The scores of female subjects were significantly different than those of males for the application questions of the W.P. of the game type activity. However, there were no significant differences on the post-test-scores of both modes of assessments, and both males and females scored higher on the W.P. Since the difference between the scores of the W.P. and V.P. were not found to be

statistically significant for both males and females, one can suggest that the use of an W.P. is likely to yield higher scores for the application component of game type activities.

For the athletic type activity there were no significant differences between the scores of males and females on the application questions of neither mode of assessment, however, the highest score was recorded on the V.P. It was also observed that the interactions of the teaching conditions and the gender were not significant for any activity on any mode of assessment. Thus, one can suggest that a class or practice-based teaching environment will not contribute to statistically significant different scores between males and females taking a V.P. for the application questions of athletic type activities.

Attendance resulted in a significant main effect for the application questions of the W.P. of the athletic type activity. This result also emerged in the case of the tactics and evaluation questions. In all three cases, subjects scored higher on the W.P., although the differences between the test scores were not significant. This means that for these content and cognitive components, learners need to attend for structured activities, however, the fact that this difference did not emerge in the case of the V.P for these three domains, leads one to suggest that the use of a V.P. for assessing these components would potentially help the subjects frame the context of the question better, at the expense of getting a lower score.

### ***7.3.3 Synthesis and evaluation (Evaluation)***

The experimental teaching conditions and gender resulted in a significant effect on both the modes of assessing evaluation for athletic type activities, as well as attendance for the W.P. The experimental teaching conditions and participation in activities other than athletics also resulted in statistically significant post-test scores for the two modes of assessment for the athletic type activities; and for gender of the game type activities. In the case of the game type activity, the experimental teaching conditions resulted in significant differences at post-test for the W.P., while for the athletic type activities, gender showed up as significant for the V.P.

For the evaluation questions of the athletic type activity, subjects from the classed based sessions scored significantly higher than the other two groups on both modes of assessment (W.P. and V.P.). It is observed that the practice-based groups scored slightly higher on the W.P. whereas the class-based group scored higher on the V.P., however these differences on the test scores were not found to be significant. These results provide evidence suggesting that significant higher scores are achievable when the evaluation cognitive domain is taught in a class-based environment. Thus, one can propose that for athletic type activities, evaluation questions are

better assessed using the V.P. and that teaching in a class-based situation needs to be seriously considered.

In the case of the game type activity, subjects from the practice-based class achieved significantly higher scores than the practice and handout group on the W.P. This result was unexpected, as the use of a handout was supposed to provide more knowledge to the subjects. It is observed that the practice class scored higher on the W.P. whereas the other two groups scored higher on the V.P., however, these differences were not found to be significant. This pattern also emerged in the case of the three content domains of game type activities in this study. These results provide evidence suggesting that teaching the evaluation skills in a practice-based environment is best assessed using a W.P., whereas a class-based course with the use of video clips, and a practice-based class with the use of handouts will yield higher scores on a V.P.

The training of observation and evaluation skills using video based and live performances has resulted in significant differences for evaluating batting skills (Eckrich *et al.*, 1994) and fundamental motor skills (Ignico, 1994). Eckrich *et al.* (1994) concluded that the evaluation of live performances of techniques potentially provide factors that hinder observation. The size of the teaching /play area and the number of students in the environment is greater during live performances. The video allows for focusing on particular areas and a smaller number of participants. The type and the amount of equipment are also an important factor to be considered. Thus, the video image might not be able to simulate the live environment and the live environment offers too many distracters for the efficient development of observational skills. The fact that the practice-based class was not exposed to video training or other visual images on handouts can partly explain why the practical based class scored significantly higher on the W.P. for all the content and cognitive domains (except for knowledge) for game type activities. Ignico (1994), also found that a group receiving video tape as opposed to teacher directed instruction for the evaluative knowledge, performance and assessment of fundamental motor skills resulted in significant differences in favour of the video instructed group on all three variables. This further reinforces the need for relevant instruction in relation to the mode of assessment. It is also noted that subjects from this study from the game activity group have shown an inclination towards the V.P., yet they scored higher on the W.P. However the differences between the scores were not significant. The use of video instruction was described as time-efficient (Ignico, 1994) and practical since it is repeatable, and can thus allow the teacher to provide additional evaluative feedback should someone be skilful at observing and poor at evaluating skilful movement (Gangstead and Beveridge, 1984).

Participation in activities other than athletic type resulted in significant differences on both modes of assessing the athletic type activities. This implies that participation in physical activities at an extra-curricular level will potentially contribute to higher scores of evaluation for both modes of assessments. However, both participants and non-participants scored higher on the W.P., therefore one can propose that the use of the W.P. is likely to yield higher scores.

Gender resulted in a significant main effect on the athletic type evaluation questions of both modes of assessment with female subjects improving their scores significantly over that of males. It was also observed that the highest score was achieved by females on the W.P. ( $m=11.25$   $S.D.=5.95$ ) whereas males obtained similar results on both papers (W.P.  $m=7.36$   $S.D.=5.43$  (V.P.  $m=7.58$   $S.D.=7.12$ ). This result does not support the analysis of the Scottish Examining Board (1995), which reported that boys did better than girls on the evaluation questions. It was also observed that the post-test scores and the interactions of the teaching conditions and the gender were not significant for any activity on any mode of assessment. Thus, one can suggest that a class or practice-based teaching environment will not contribute to statistically significant differences between the score of males and females taking a W.P. for the evaluation questions of athletic type activities. There is evidence suggesting that the use of the W.P. is likely to yield higher scores for the evaluation component.

For the game activity evaluation, gender resulted in significant different post-test scores for both modes of assessment (W.P. and V.P.). It is observed that females scored higher than males on the two modes of assessment and that the highest score emerged from the W.P. Thus, one can propose that for game type activities, evaluation questions are better assessed using the W.P. and since the interaction of the teaching conditions and the gender was not significant for any activity on any mode of assessment, one can suggest that a class or practice-based teaching environment will not contribute to statistically significant differences between the score of males and females taking an W.P. for the evaluation questions of game` type activities.

#### **7.4 Summary**

The analysis of the impact of the two modes of assessment on the content and cognitive domains of the two activities understudy have lead to some preliminary proposals with regards to the assessment of the specific content and cognitive domains for each activity type. Table 7.1 provides a summary of the results with reference to the ETUs and physical activities.

Table 7.1: Summary of proposed best teaching environments and modes of assessments for the content and cognitive domains of the two types of activities.

<i><b>Content/cognitive domains</b></i>	<i><b>Teaching environment</b></i>	<i><b>Mode of Assessment</b></i>
<b>Athletic Type Activity</b>		
Techniques	Class based	Video based (written)
Tactics	Class based/ Practice and handout/ Practice-based	Video based (written)
Rules	Class based	Video based (written)
Knowledge and comprehension	Class based	Video based (written)
Application and analysis	Class based	Video based (written)
Synthesis and evaluation	Class based	Video based (written)
<b>Game Type Activity</b>		
Techniques	Class based/ Practice and handout	Video based (written)
	Practice-based	Written paper
Tactics	Class based/ Practice and handout	Video based (written)
	Practice-based	Written paper
Rules	Class based/ Practice and handout	Video based (written)
	Practice-based	Written paper
Knowledge and comprehension	Class based/ Practice and handout/ Practice-based	Video based (written)
Application and analysis	Practice-based/ Practice and handout	Written paper
Synthesis and evaluation	Class based/ Practice and handout	Video based (written)
	Practice-based	Written paper

For the athletic type activity, teaching in a class-based environment has resulted in significant higher scores with the use of the video based unseen written paper, however, the teaching of tactics in any environment resulted in higher learning gains with the use of the video based paper too. The teaching of the of the game type activity in a practical performance teaching situation prepared students better for the W.P. except for knowledge. Meanwhile students in the practice-based classes that discussed handouts, together with students taught in a class-based environment achieved better scores on the V.P. Thus, in the case of the game type activities for an assessed course in PE, there is evidence suggesting that teaching in the practical setting without giving handouts or any written activities, assessment through written activities will yield higher learning outcomes than the use of video based written activities, except for knowledge. However, when teaching is practice-based and includes handouts, or class-based and incorporates video clips, handouts and written activities, higher scores will be achieved through the video-based unseen written paper.

In the case of the significant main effects of gender, attendance and participation in physical activities, the proposed modes of assessment are given in table 7.2:

Table 7.2: Summary of proposed modes of assessments for selected content and cognitive domains of the two types of activities and gender, attendance and participation in physical activities.

<i><b>Content/ cognitive domains</b></i>	<i><b>Mode of Assessment</b></i>	
	<b>Athletic Type Activity</b>	<b>Game Type Activity</b>
Techniques	<ul style="list-style-type: none"> <li>• Males &amp; Females: Video based (written)</li> <li>• Participation in athletics Video based (written)</li> </ul>	<ul style="list-style-type: none"> <li>• Males &amp; Females: Written Paper</li> </ul>
Tactics	<ul style="list-style-type: none"> <li>• Attendance Video based (written)</li> <li>• Participation in other physical activities Video based (written)</li> </ul>	<ul style="list-style-type: none"> <li>• Attendance Written Paper</li> </ul>
Rules	<ul style="list-style-type: none"> <li>• Participation in other physical activities Written Paper or Video based (written)</li> </ul>	<ul style="list-style-type: none"> <li>• Males &amp; Females Video based (written)</li> </ul>
Knowledge and comprehension	<ul style="list-style-type: none"> <li>• Males &amp; Females Video based (written)</li> <li>• Participation in other physical activities Video based (written)</li> </ul>	<ul style="list-style-type: none"> <li>• Males &amp; Females Video based (written)</li> <li>• Participation in netball Video based (written)</li> </ul>
Application and analysis	<ul style="list-style-type: none"> <li>• Males &amp; Females Video based (written)</li> <li>• Attendance Video based (written)</li> </ul>	<ul style="list-style-type: none"> <li>• Males &amp; Females Written Paper</li> </ul>
Synthesis and evaluation	<ul style="list-style-type: none"> <li>• Males &amp; Females Written Paper</li> </ul>	<ul style="list-style-type: none"> <li>• Males &amp; Females Written Paper</li> </ul>

<i>Content/ cognitive domains</i>	<i>Mode of Assessment</i>	
	<b>Athletic Type Activity</b>	<b>Game Type Activity</b>
	<ul style="list-style-type: none"> <li>• Attendance</li> <li>Video based (written)</li> <li>• Participation other</li> <li>Written Paper</li> </ul>	

When the proposals of the modes of assessments of all significant mediating variables are taken into account, there emerges a support for the assessment of all the athletics domains using the video based assessment, however, rules will yield similar scores when assessed using the written paper with diagrams while evaluation is best assessed using the written paper to narrow the gap of gender inequalities in assessment. For the game type activity there resulted a consolidation of the proposal of the knowledge component to be assessed using a video-based paper and for the application component using a written assessment with respect to the gender balance.

The differences that emerged between the two types of activities and the other mediating variables with regards to the modes of assessing the content and cognitive domains have partially supported the hypotheses. These findings indicate that the mediating variables identified in this study, and possibly others need to be tackled in greater depth with reference to all the classifications/areas of activities of PE and Sport Studies syllabuses.

The task of bringing together the findings of the description of the experimental teaching units and the complexity of the diversity of the proposals of the modes of assessments will be tackled in the next chapter.

## CHAPTER 8

### CONCLUSION AND RECOMMENDATIONS

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#### 8.1 Introduction

This study set out to investigate the links between the teaching and assessment of content and cognitive domains of the performance coursework of assessed PE and the findings partially supported the hypotheses. This chapter will highlight the implications of these findings with reference to teaching and assessing physical education and teacher education, as well as address the areas that require further inquiry for future research.

#### 8.2 Teaching examined physical education

The teaching aim of the experimental teaching units (ETUs) was to deliver selected subject-content and the cognitive skills of knowledge, application and evaluation of two physical activities. The subject-content was physical activity specific and included techniques, tactics, rules and umpiring. These teaching objectives were similar to those of GCSE PE. The changes that teachers might have needed to make to their teaching strategies to include these content and cognitive requirements of an assessed course in PE were not discussed in depth in the literature. Research and reporting of what actually goes on in the "examined" PE route classrooms has been limited to how teachers coped with the introduction of knowledge and understanding (Stirling and Scott, 1989) and the analytic (Forsyth, 1994) components.

Meanwhile, examiners of the various examining boards have often showed their concern about the lack of knowledge shown by candidates. Statements such as "a good depth of theoretical knowledge was often shown to be lacking" (SEG, 1991, pg. 2), that candidates "confused technique with rules or style of play" (SEG, 1994, pg. 4), that "questions requiring knowledge and understanding of specific terminology indicated that many candidates were not acquainted with the terms" (ULEAC, 1994, pg. 6) and that "umpire's signals were known only to a few candidates" (ULEAC, 1995a, pg. 5) have been regularly reported at GCSE level. At advanced level, the observation/analysis/synthesis component was identified as an area where candidates were not being adequately prepared (AEB, 1995, pg. 18). Examiners have also suggested various strategies for better teaching. Some proposals were useful, such as informing the coaches who take classes of the physical activity content requirements of the syllabus (AEB, 1997b, pg. 17). Other recommendations were not clear and often gave rise to confusion. For example, the proposal to teach activities in the classroom as well as through the activity (MEG, 1993, pg.7) and the suggested increase of practice time due to the split of the assessments of analysis/ correction/ synthesis (AEB, 1997b, pg. 18) leads one to question which content and cognitive components should be taught in class, through the practical sessions or both.

From this study the issues related to the teaching of assessed PE were central and from the results and discussion the following inferences can be made. Teaching a physical activity for

the “assessed” pathway of PE required the refinement of the teaching objectives such that they addressed both the content and cognitive domains of each physical activity taught. General objectives of the sort found in syllabuses, which were physical activity content and cognitive free (Vickers, 1990), did not help to place the structure of the course into context, especially when a variety of teaching environments (class and practice) were used.

The compilation and structuring of the objectives and content (techniques, tactics and rules) of the ETUs for the physical activities for assessed PE revealed consistency amongst the examining boards. The validation by experts resulted in consensus with respect to what was considered appropriate, technically sound, complete, feasible, relevant and important with regards to objectives and content. It was observed that one content component, rules, was covered to the barest minimum in the GCSEs and ‘A’ level syllabuses and treated with different depth by the experts.

In the case of the game type activity, the specification of rules to be included in the course was presented in detail (i.e. extracts from the rulebook referring to articles and the relevant subsections) and some experts’ comments included references to rules proper. In the case of the athletic type activity, the rules content was presented through general statements such as laws relating to disqualification and acceptable codes of behaviour, safety of equipment and details of the weights for competitive events. None of the athletics experts commented on the brevity of these rules, suggested additional ones, or referred to official rule article numbers in their comments. It is not clear why the rules content is treated as not worthy of elaboration (across all physical activities) by the examining boards. It is also surprising how athletics experts were happy with general guidelines indicating the rules content knowledge. This leads one to suggest that further probing into the perceived importance of the rules, laws and etiquette of the various physical activities offered for assessed courses is required such that some kind of equivalence with regards to the depth of content knowledge will be established for each physical activity. There is also a need for a stratification of the physical activities’ performance coursework content knowledge of GCSE and ‘A’ level items in the syllabuses. There is an unnecessary repetition of subject content knowledge, especially in the case of techniques.

The teaching of the athletic type (athletics) and game type (netball) activities in class and practice-based environments resulted in some similarities and differences. All teacher and student behaviours were found to be statistically significant across the teaching environments, save for criticism of the teacher, which was hardly ever used in any class. The acceptance of student ideas, the giving of information by the teacher through demonstrations of activities, and the use of questions were behaviours found common in both the athletic and game type classes.

In practice-based sessions, the use of the demonstrations of activities accompanied with verbal descriptions was a common form of presenting subject-content knowledge. However, during the game type sessions, students spent more time motor/cognitively engaged than in the athletics classes, as the latter required more management time. In practice-based sessions students of both athletic and game type activities had fewer opportunities of being questioned

and communicating on the verbal level. The class-based sessions gave more room for the use of student ideas as well as teacher questioning and verbal and written communication. The time spent on management was much lower in class-based sessions and significantly different from sessions in the practical environment. The giving of information by the teacher, media (video clips, handouts and worksheets) and the students (through demonstrations) were the predominant behaviours across all classes. The second most prevalent behaviour was student motor/cognitive engagement.

The use of CAFIAS as a descriptive tool of what went on in the classroom covered teacher and student behaviours and the sources of information giving (teaching). It was not possible to gauge the time spent on specific content and cognitive domains in the different teaching environments.

The use of the teaching resources during the experimental teaching sessions included a variety of items. Physical activity equipment of both game and athletic type activities was used in class and practice-based sessions. In the practice-based classes this made performance time relevant and enjoyable, as commented in the subjects' evaluation sheets. In the class-based sessions the demonstration and manipulation (through structured activities) of equipment that was normally associated with use in the practical setting (e.g. netball bibs, netball ball, athletic starting blocks, relay baton and shot put) was a common teaching strategy. This was done to bring the context of the physical activity into the session. Students were given an opportunity of an encountering experience with the equipment, and this helped them to relate more enthusiastically to the video clips, to bridge the gap between the known and the unknown, and to help visualise the performer's action when presented with tasks requiring analysis and evaluation. In addition to the use of equipment, teacher made handouts and written worksheets were used. The need for the teacher to compile these teaching resources, especially in the case of the game type activity became necessary as the availability of books/ videos/ written worksheets addressing the requirements of the assessed performance coursework component of PE were not completely readily available. Some books included knowledge description and visuals of either or a combination of techniques, tactics and rules with very few resources addressing the cognitive components of knowledge, application and evaluation. The use of written tasks in these informative sport specific books were not common and there was an absence of exam type questions (oral / writing).

The video clips used in the class-based sessions also had to be selected by the teacher. This required repetitive previewing to select short clips (3-7 minutes) to be viewed in class for the purpose of description, application, analysis and evaluation of the various content components. The teacher also prepared questions for discussion and written exercises. The athletics 'A' level resource pack (Roscoe, 1997) was a vital source for the athletics activity, however, it was not exclusive. The course content for the athletics ETUs included relays, which were not part of the 'A' level syllabus. This necessitated the production of handouts using other books and the use of an additional video that included relays. The process of viewing and logging the videos was time consuming and readily available video based resources covering the content and cognitive domains of assessed physical activities are recommended. The use of teacher-recorded class sessions for analysing and evaluating techniques, tactics and rules require of teachers to set up situations in addition to adequate

video editing facilities, with which most teachers are not likely to be familiar or have access to. The changes of the rules of sports activities every four years (athletics, netball, football, gymnastics, etc), would require regular update of editions of these resources due to the changes in rules' items and their impact on techniques, tactics and their application and evaluation.

From the processes required to construct these teaching resources, teachers would gain first hand information of specialised physical activity content knowledge, however, it is felt that the need for professionally produced teaching resources (interactive video discs and exercises, web sites, videos and packs, books) addressing the requirements of examined PE is evident. Given the various options for the selection of physical activities (4-5) for GCSE and advanced level (2) PE, it is more convenient for teachers and students to have access to single physical activity specific resource packs, including written and visual media and documentation. It is somewhat surprising that the practical coursework content of examined PE is taking so long to gain the attention of publishers and sports associations. The commissioning of the production of these resources to sports associations is strongly recommended, not just because these have a background and a history of collaborating and assisting with the production of media, but also because that is where the sport specific expertise and access to filming of performances lies. The funding of this initiative through lottery money, as was the case of the "Raise the game" teaching resources is recommended.

The use of the different varieties of teaching strategies, equipment and resources used in both the practice and class-based sessions was a source of motivation for students, as commented in their evaluation of the ETUs. The impact of the teaching environment and the use of the teaching resources resulted in significantly different learning gains. The class-based sessions provided an opportunity for the subjects of athletic type activities to improve their scores over time significantly better than the other practice-based classes for all the content and cognitive domains except for tactics, where class and practice-based teaching emerged as significant. This suggests that teaching athletics in a class-based environment is recommended, however, for the tactics component, practice-based sessions are appropriate too. For the game-type activity, the class-based sessions and the practice and handout classes performed better than the practice-based class on all content and cognitive domains with the use of the V.P. The practice-based class performed better than the other two groups on all content and cognitive domains when assessed through the W.P.

### **8.3 Assessing and examining physical education**

The use of different modes of assessing the physical activities from selected areas of activities resulted in significant different results with reference to both content and cognitive domains and the teaching environments. The findings of this study partly support these hypotheses. The results suggest using different modes of assessments for the various content and cognitive domains of the two types of activities studied. The implications of this proposal are discussed in the following section.

One examining board suggested that the assessment of the performance coursework related to the understanding (application, analysis and evaluation) of quality of performance could be achieved in a variety of ways

“ orally (question and answer, discussion, commentary); written; diagrammatically; by reference to a practical performance by a candidate, teacher, member of a group. This could also involve showing a film, photograph, posters”.  
(SEG, 1997a pg. 15 – 30; SEG 2000)

When a statement like this is used with every physical activity to be assessed from any of the areas of activities of examined PE one needs to question why are these unstandardised modes of assessments being recommended? Although this suggestion provided a lot of freedom to the administration of this assessment component and also made the teachers' role central to the development of assessments, it also explains how complex and varied assessments of performance coursework can be. The next stage was to consider the implications of this suggestion and to frame it within the context of the principles of validity, objectivity, reliability and clarity of PE assessments. This led to the question of whether there are more valid and reliable modes of assessments with reference to content and cognitive performance coursework assessments of physical activities from different areas/families of activities.

The development of the unseen written paper (W.P.) and the video based unseen written paper (V.P.) for the purpose of assessments were more complex because these required the adaptation of questions from published past-papers used by examining boards in the United Kingdom and question banks, in conjunction with video clips. The construction of the video-based assessments required the permission for use of copyrighted videos from the publishers for educational purposes and the use of sophisticated video editing equipment. These made the job more expensive (hiring video-editing suits and the service of a technician) and time consuming, in relation to the unseen written paper with diagrams. The validation of the questions used in the assessments for their relevance, clarity, correctness and technical soundness resulted in agreement amongst the experts. The validation of the video clips on the criteria of appropriateness and technical soundness resulted in minor yet worthwhile recommended changes in the case of the athletics assessment.

The impact of the use of the W.P. (questions accompanied with diagrams) and the V.P. (questions accompanied with video clips) on the content and cognitive domains resulted in statistically significant main effects for the two physical activities and the experimental teaching units (ETU), gender, attendance, and participation in athletics/netball and other activities.

In the case of the athletic type activity, the pattern that emerged for the content domains, also resulted for the cognitive domains, namely that statistically significant higher scores were achieved on the V.P. by the subjects who were taught in the class-based environment. Thus, one can suggest that for the athletic type activities, assessing the content and cognitive domains through the video based unseen written paper and teaching the content in a class-based environment will yield significant higher scores than a written paper with diagrams. However, rules will yield similar scores when assessed using the written paper with diagrams while evaluation is best assessed using the written paper to narrow the gap of gender inequalities in assessment.

When the game type activity was taught in a practical based class, the unseen written paper (W.P.) was found to yield higher learning gains for the techniques, tactics, rules, application and evaluation questions, but not on knowledge. This result was found to be quite perplexing, since students taught in the practical setting are used to visual demonstrations during their classes, and were expected to perform better on the video based assessment. However, as Eckrich *et al.*, (1994) observed, the evaluations of live performances of techniques potentially provide factors that hinder observation. This implies that teachers and examiners should not assume that because the students have been exposed to “seeing” performance of skills and tactics, they are also developing observation skills to describe, analyse and evaluate live and video performances. The skills of observation, analysis and evaluation require training through structured activities. Students need to be asked to look for specific performance characteristics that resemble the right technical model or a faulty performance. For example, “observe your partner (or an athlete on video) and describe the movement s/he is making with the head while running. Is the athlete looking squarely ahead, down or up? Is the athlete shaking the head from side to side?” When students can communicate what they see, they are building their observation powers and knowledge of a correct and a faulty technique. Providing students with sources of references of this knowledge in the forms of handouts or written work sheets is recommended, so that they will have something to go back to. Giving reasons why certain faults took place, their effect on the performance and how it can be remedied and improved requires further interactive structured activities in the form of assignments of experimental nature.

It has been noted that preparing students for observations in a live situation using videos is not recommended (Eckrich *et al.*, 1994) since the video image might not be able to simulate the live environment. The size of the play area and the number of subjects is very often greater during live performances. While this statement was put forward following a study on batting skills, one needs to further investigate whether this is also true for other physical activities from the different areas of PE syllabuses.

For the game type activity, it was also observed that for the video based unseen written paper (V.P.) the highest scores for the content and cognitive domains were achieved by the subjects in the Physical Education coursework group (practice-based sessions and handout) and the Sport Studies group (class-based). Since for the V.P. the Physical Education group (practice-based class) scored lowest and gained the least learning gains on all content and cognitive domains, one can suggest that a practice-based class does not adequately prepare students for video based assessments with a written paper.

In the case of the game type activity, the knowledge component achieved higher scores on the V.P., however the teaching environment did not have any impact. This implies that whether subjects are taught in a performance or class-based environment, they will score higher on a V.P. In the case of the application component, subjects from the performance-based classes scored higher on the W.P. leading one to suggest that the application component is better taught in the practical environment and assessed using a W.P. The assessment of the evaluation component resulted in the same pattern that emerged for the content domains of the game type activity, where the practice-based class achieved higher scores on the W.P. and the other two groups, recorded higher results on the V.P. It is thus recommended that for

game type activities, practice-based classes ought to be assessed using written papers with diagrams, however the knowledge domain is best assessed using a video based written paper. When teaching incorporates practical sessions and the use of handouts, or class-based sessions video clips, handouts and written activities; video-based unseen written papers ought to be used for all the content and cognitive domains of game type activities, except for analysis, which benefits more from a written paper with diagrams.

With regards to the assessment of the cognitive components at post-test, subjects from both physical activities scored highest on the first two levels of Blooms' cognitive taxonomy namely, knowledge and comprehension, lower on application and analysis (levels three and four) and lowest on synthesis and evaluation (levels five and six) for both modes of assessments (W.P. and V.P.). This implies that the classification of the questions used for the assessments supported the hypothesis that Bloom's cognitive levels are hierarchic. The implications of this finding for both teaching and assessment is that cognitive components ought to be included in the course content and the table of specifications. Given that the findings of this study suggest that the lower levels of Bloom's taxonomy are pre-requisites for the higher levels, one can also add that the stratification of all the cognitive components for the content knowledge of assessed physical activities is appropriate.

Gender contributed to significantly higher scores for female subjects on techniques, knowledge and analysis for the V.P. and evaluation for the W.P. in the case of athletics. For the game type activity females achieved significantly higher scores on techniques, analysis and evaluation on the W.P. and rules and knowledge on the V.P. The result that females have outperformed male subjects through written modes of assessments (diagram and video based) suggests that this form of assessment positively discriminate in favour of female subjects. It has also been reported that females scored higher on the top grades of GCSE and 'A' level PE (Carroll, 1995), however this has not encouraged girls to take up examined PE as a course of study and narrow the under-representativeness of girls in the subject. If boys do better in the performance assessments (SEB, 1995) and girls do better in the written assessments, one should seriously consider positively discriminating with both gender groups. This study has not looked at performance assessments and further investigation of this assessment component needs to be made with reference to gender and physical activities from different areas of the syllabus (i.e. athletic activities, dance, games, gymnastics, outdoor and adventurous activities and swimming).

The oral assessments that are being suggested and used for the purpose of assessing performance coursework (SEG, 1997a pg. 15 – 30; SEG 2000) have not been used in the main study, however, the pilot study showed that oral assessments using open ended questions were relatively subjective to mark because subjects were either going in depth on one item or showed a wider base of knowledge for a variety of situations. It also emerged that oral type assessments with open-ended questions make it difficult to include a representative sample of questions on the content knowledge taught, as is possible through a table of specifications. The fact that subjects were not questioned on specific situations in the oral exams made the assessment subjective. The oral assessment provided an opportunity for subjects to express themselves better, as noted by the some candidates in the pilot study and a few others in the main study. However, oral assessments can be time consuming to administer and mark from a

recorded (visual/audio) medium. Nevertheless further research and investigation about the construction, validity, balance and variety of content items and marking needs to be done in the area of oral assessments in PE. There is still no evidence suggesting or supporting the fact that oral assessments by the teacher are more valid than unseen written papers that were in use until the examination sittings of 1997. The fact that this change was more of a cost cutting strategy is not being excluded and if this is the criteria on which decision making with regards to the selection of modes of assessment is being made, than the examining boards are failing to address the principles of assessments and the aims of the syllabus.

#### **8.4 Implications of the study for teacher training**

In the course of this study, there were moments when it was felt that teachers involved in teaching assessed physical activities in PE would benefit from possessing further skills and professional training in areas of teaching and assessments. The extension of the practice-based courses from performance and competitive game playing and umpiring to the “teaching” of content and cognitive domains of physical activities is a necessity. The inclusion of performance and pedagogic orientated courses of all six areas of activities of the PE National Curriculum / GCSE performance coursework syllabuses of as many physical activities is also recommended. The ongoing professional development of the PE teacher requires building up a repertoire of content and pedagogic knowledge, thus after formal teacher education, this development can be addressed through in-service courses and by encouraging teachers to keep in touch with the regular publications and courses offered by sports associations and educational institutions.

The pedagogical content knowledge that one can propose to be included in the professionalisation of the PE teacher, in particular those delivering examined PE and Sport Studies courses can include a variety of teaching styles and strategies for teaching the content and cognitive domains of physical activities in performance and class-based environments. Some more attention needs to be given to teaching the skills of observation, analysis, application, evaluation and synthesis. The production and use of teaching resources including models, video based and CD Rom based activities together with handouts, written worksheets and research type assignments is an area that deserves some more time and attention on teacher training courses. The use of video equipment and basic editing (computer based) is also becoming a necessity for the observation, analysis and improvement component. The requirement to construct and mark assessments for a variety of physical activities also require teachers to be prepared in the areas of assessments, test construction and administration.

#### **8.5 Implications of the study for future research**

This study has identified the teaching environments that are likely to contribute to higher learning outcomes and the modes of assessment for more valid and reliable examinations of content and cognitive domains from two (athletic activities and games) of the six areas of physical activities found in the syllabuses of GCSE and ‘A’ level PE. This research needs to be extended to the other areas of physical activities of the syllabus (dance, gymnastics, outdoor and adventurous activities and swimming) and further in-depth analysis of the sub-categories of game type activities (net/wall; striking/fielding/target; invasion) is recommended, especially with the introduction of the Physical Education (Games) syllabus as an examinable course in its own right. This study has not included performance-based assessments, however research into the validity and reliability of the assessment of the motor abilities of candidates as

separate from cognitive abilities is recommended. This need was felt since the assessment criteria published by examining boards included suggestions that imply assessing the same component (e.g. evaluation, analysis and improvement of performance) more than once.

The use of teacher administered performance assessments, in particular the oral and written assessments recommended by the examining boards can provide a wealthy field worthy of investigating what and how are teachers assessing physical activities in PE with reference to the principles of assessments. In the process of selecting and constructing the objectives, content knowledge and modes of assessments of the ETUs, it transpired that performance coursework content items are replicated in GCSE and 'A' level syllabuses. It is felt that this does not do justice to the students, the subject or the teachers and the stratification and validation of performance content knowledge of examined PE is recommended. It was also felt that some kind of parity with regards to depth of content of the physical activities need to be achieved, and an investigation into content and cognitive domains prescribed in the syllabuses is proposed with reference to rules, umpiring/officiating and the analysis and improvement of performance component.

This study has attempted to look into what goes on in the PE class following the "assessed" route, however it has been limited to describing the teacher and student behaviours and sources of teaching. Systematic observation instruments geared at the examined PE class are necessary such that one can describe and measure teacher and student behaviours with reference to content and cognitive domains. The teaching process involved in the ETUs also revealed that the production of teaching resources for the purpose of addressing the content and cognitive requirements of an assessed course are very time consuming and some interactive and relevant teaching resources from reliable and technically informed and equipped sources such as sports associations and publishers are recommended.

These findings of the teaching and the assessment studies have revealed the complexity of the process – product link in the learning process and the suggestions made with reference to the teaching and assessment of the content and cognitive domains with respect to the two activities understudy might sound rigid, however they are not new. Examiners have been recommending a whole range of modes of assessment and what this study has done is precisely weigh up these suggestions with reference to teaching and areas of activities of examined PE. These two areas have been previously treated in isolation in physical education research and not with reference to assessed physical activities in PE. The recommendations and suggestions of this study attempt to contribute to more valid, reliable and relevant modes of assessments.

## **8.6 Summary of conclusions**

This study set out to investigate various research issues, which comprised aspects on both the teaching and assessment of the content and cognitive domains of two physical activities. After ample considerations of what should constitute the experimental teaching conditions, the experimental modes of assessments and the explanatory variables (independent variables), hypotheses were formulated. These incorporated most of concerns showed through the research issues; however, oral based assessments were not thoroughly investigated. Consequently, the issue of whether there are more valid ways to assess the content and

cognitive components of physical education coursework were not explored either. The focus of the ETUs study was on showing any differences in the scores of the content (techniques, tactics and rules) and cognitive (knowledge, application and evaluation) components of the two assessment instruments; the unseen written paper (W.P.) and the video based unseen written paper (V.P.). This was in relation to five independent variables namely: experimental teaching conditions, the two physical activities, gender, participation in other physical activities.

From the testing and analysis of the hypothesis there emerged statistically significant differences and main effects on various content and cognitive domains. The following conclusions can be made:

The experimental teaching conditions resulted in significant main effects on the two modes of assessment. This led to a somewhat complex proposal with regards to the teaching environment and assessment of the specific content and cognitive domains for each activity type. For the athletic type activity, teaching in a class-based environment resulted in significantly better scores for all the content and cognitive domains with the use of the video based unseen written paper. However, tactics could be taught in any teaching environment.

The teaching of the game type activity in a practical performance teaching situation prepared students better for all the content and cognitive components of the W.P. However, the knowledge and comprehension component could be taught in any environment, and better scores resulted when the assessment was through the V.P. Meanwhile, students in the practice-based classes that discussed handouts, together with students taught in a class-based environment achieved better scores on the V.P. on all content and cognitive domains except for application and analysis questions. These resulted in better scores when taught in a practice-based environment and assessed using a W.P.

When all mediating variables are taken into account, there emerges a support for the assessment of all the athletics domains using the video based assessment. Yet rules will yield similar scores when assessed using the written paper with diagrams while assessing evaluation using a written paper will narrow the gap of gender differences in assessment. For the game type activity there was support for the proposal of the knowledge component to be assessed using a video-based paper and for the application component using a written assessment with respect to the gender balance.

The use of teaching resources such as handouts in addition to practical performance did not result in significantly better scores in the case of the athletics. Nevertheless, class based teaching including discussions, the use of handouts, worksheets and video clips resulted in better results for the athletic type activity. The use of these teaching resources resulted in better scores for the game type activity when the assessment was video based.

There were statistically significant main effects for gender for the athletic type activity for techniques, knowledge, evaluation and total scores of the W.P., and evaluation in the V.P. In the case of the game type activity, gender emerged as a significant main effect in the application domain of the W.P.

Participation in physical activities resulted as a significant main effect in the case of the game type activity only for application and total scores. This was due to the substantial increase in scores from pre-test to post-test of those who had not participated in netball before. Participating in physical activities other than athletic and game type did not result in any statistically significant differences or main effects.

With regards to the mode of assessment there emerged statistically significant differences for the W.P. and V.P in the case of rules for the athletic type activity and for all content and cognitive components for the game type activity at pre-test. However, there emerged no statistically significant differences between the assessment instruments in both papers at post-test. Statistical significance resulted in both modes of assessment for both types of activities for their scores from pre-test to post-test on both modes of assessment.

There resulted statistically significant interaction effects between the experimental teaching conditions and the physical activities for all the content and cognitive components of the V.P. This was partly explained by the class based (Sport Studies) athletics groups who outperformed the other groups.

The subjects who were engaged in the six different groups in the study found the three teaching modes relevant and they showed a preference for the video based written paper irrespective of whether videos were used or not during their teaching sessions. The idea of oral assessment received more of a negative sign of acceptance.

In the case of CAFIAS behaviour categories there emerged significant differences for all behaviours except for teacher criticism in the case of the ETUs. Physical activities also resulted in significant differences on all CAFIAS behaviours except for teacher acceptance and use of student ideas, the use of questioning and use of demonstrations for teaching. With regards to Bloom's cognitive domains, the percentage scores of the subjects show consistent decrease from the lower level (knowledge and comprehension) to the highest level (synthesis and evaluation) of cognitive domains for both papers (W.P. and V.P.) and both modes of assessment. This suggests that there is evidence suggesting that the six domains are possibly hierarchical. Further research in this area is recommended in all areas of physical activities for assessed and examined physical education.

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