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Embedding epistemic insight (EI) in teacher training programmes in English universities: barriers and how to overcome them

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ABSTRACT

Entrenched compartmentalisation of curriculum subjects and ‘teaching to the test’ can leave students with limited understanding of the nature and interaction of disciplines. The necessity of developing future teachers’ epistemic insight (EI) and equipping them with strategies to address the gaps between subjects has been pushed to the fore by challenges that emerged during the pandemic. This article examines the extent to which epistemic insight is understood by Initial Teacher Education tutors and features in their programmes as well as their recommendations for increasing the inclusion of multidisciplinary approaches in education, based on qualitative and quantitative research. While initial findings revealed a poor understanding of EI, its importance was broadly acknowledged, and the follow-up survey revealed progress in the form of greater engagement with and inclusion of EI by tutors in teacher education. This research was done in the context of a new inspection framework distinguishing substantive and disciplinary knowledge.

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1. Introduction

Young people face unprecedented social, economic and environmental challenges and opportunities. Accelerating globalisation and rates of technological developments are reasons for educators to equip young people with tools and insights that they can draw on to address a wide range of problems – some known and many as yet unknown (OECD 2018, 2). The importance of global issues such as the COVID-19 pandemic, climate change, the power of genetic technology and the implications of artificial intelligence for individuals and society, as well as their potential to stimulate student interest, make them strong contenders for inclusion in the school curriculum as ways to build young people’s epistemic insight. This includes teaching about the natures and interdependencies of various disciplines (Billingsley and

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Hazeldine 2020; Boix Mansilla and Chua 2016; Greene and Seung 2016; McGregor and Frodsham 2019) as a component of creating transferable competencies necessary to prepare them to be citizens of the future (OECD 2020).

Despite recognition by national and international bodies of the importance of epistemic insight and interdisciplinary approaches in preparing students for future challenges, our research indicates that change to the rigid subject compartmentalisation has been limited. Calls by professional associations for teachers and academics to encourage pedagogies seeking to reduce knowledge fragmentation with the aim of preparing students to address global concerns and 'big questions' (Erduran 2020) have so far failed to achieve substantial practical change. Some of these issues have now been picked up in a new schools inspection framework operating in England, the country that forms the context for this research (Ofsted 2019; Roberts 2018). The aim of our article is to discern opportunities and barriers to teach epistemic insight in teacher education, where epistemic insight means knowledge about knowledge and, in particular, knowledge about disciplines and how they interact (Billingsley et al. 2018). This includes appreciation of disciplinary similarities and differences in terms of type of questions they ask, methods and norms of thought. Developing epistemic insight is important particularly in answering Big Questions and solving complex global issues, and as such supports development of disciplinary knowledge (Ofsted 2019) and enriches interdisciplinary knowledge (OECD 2020) to enhance solutions to real-world problems.

The article presents the findings of aggregated data from two sources: an interview study carried out with teacher educators a year after the announcement of Ofsted's new inspection framework (OECD, Ofsted 2018) and a follow-up short survey with those tutors a year later. The interviews were aimed at identifying tutors' understanding of epistemic insight, the extent to which epistemic insight featured in teacher education programmes in their institutions, barriers to implementing epistemic insight strategies and their recommendations in overcoming them. All tutors agreed that epistemic insight (EI) was not adequately addressed and should feature in their teacher training programmes. The two main barriers identified in the implementation of EI were the dominance of discipline-specific content knowledge and the lack of resources. Most of the recommendations that tutors made for overcoming these barriers referred to creating resources for EI that could be utilised in their teacher education programmes. Although most tutors identified the need for top-down change, they also identified ways of implementing EI within existing programmes by changing attitudes and teaching practice.

A follow-up study was conducted to research whether and how tutors' attitudes to EI had changed after a year of working with EI concepts, strategies and resources. We were interested in the evolution of tutors' understanding, the extent to which EI had become embedded into the programmes and whether any of the initially identified barriers had been overcome. Following initial interviews, seven of the 10 tutors embarked on a collaboration with the authors as a part of consortium of institutions within the Epistemic Insight Initiative (www.epistemicinsight.com), a large-scale research and innovation project, with its focus on implementing a curriculum framework for EI (Billingsley and Hazeldine 2020; Billingsley et al. 2018). This project was designed to increase teacher educators' EI understanding and enable them to take advantage of the expertise and tools available, with the

aim of better incorporating EI into existing teaching modules. Moreover, some tutors made changes to their own teaching and even set up new modules based around interdisciplinary approaches.

These findings indicate the necessity of further development of EI understanding among future teachers and teacher educators, as well as the creation of resources supporting teaching about the nature of knowledge and multidisciplinary approaches for schools and teacher education providers. This is particularly relevant in the context of the newest OECD Future of Education and Skills 2030 project, which highlights the importance of interdisciplinary knowledge, whether by combining subjects or by supporting project-based learning in newly created subjects (OECD 2020).

2. Teaching knowledge about knowledge

Education in schools, both in England and around the world, has become locked into a range of pedagogical practices. One habit with unintended consequences on students' understanding of knowledge is the division of the timetable into separate subject slots (Billingsley and Nassaji 2021; Billingsley, Nassaji, and Abedin 2017; Fung 2017). Many subjects teach students to work in a scholarly way only within a given discipline. Students rarely – if ever – have opportunities to work with two or more disciplines together (Billingsley et al. 2018). Teaching is currently confined to the narrow context of each independent discipline and limited by a focus on subject-specific content knowledge. This model has an impact on students' capacity to build and use their epistemic insight as they tend to address only questions directly suited to a particular discipline, with the neglect as such of some cross-disciplinary questions.

3. Historical context

In the late 1980s, the National Curriculum (NC) in England for pupils ages 5–16 (DES 1987) was introduced, changing the general approach to teaching from teacher designed to government centralised (Alexander 2010, 28; Shaw and Shirley 2011), with a focus on delivering content knowledge rather than facilitating teaching in a creative way (McGregor and Frodsham 2019). A 'prescriptive' list of subjects was introduced along with 'cross-curricular dimensions, skills and themes' (Dufour 1990, 1). This has been described as including 'a strong component of knowledge and understanding in addition to skills', with the comment that 'most can be taught through other subjects as well as through themes and topics' (NCC 1989, 6).

Since the introduction of the NC, successive governments have made changes in respect of both content and delivery (MacBeath 2011). While this has included the introduction of cross-curricular themes and skills, the resulting cross-curricular teaching has been criticised as not being of the highest order (Pumfrey 1993, 21) owing to limited guidance for teachers and limited teacher–government consultation prior to its implementation, described as 'reducing teachers to agents of policies decided elsewhere' (Ball 1990, 171). The potential for cross-curricular teaching was further curtailed by its non-statutory status; it was reduced to a marginal role (Crawford 2000) owing to the difficulty

of combining cross-curricular themes with separate subjects, the lack of a holistic approach among teachers, as well as missed opportunities for links between subject and cross-curricular themes (Savage 2010). This has been the case in both primary and secondary education, despite the impression that ‘topic based’ or cross-curricular teaching might be easier in the former, where there is frequent teaching across subjects and the more ‘generalist’ remit of primary teachers. While NC reforms have gradually allowed for greater flexibility in subject timetabling (Boyle and Bragg 2008), overall cross-curricular teaching has not been uniformly implemented for education in England.

Where a cross-curricular approach is adopted, in most schools it is restricted to an adoption of a broader theme explored separately within each subject (Ofsted 2008). However, it is useful to note that the limited impact of a thematic approach is not unique to the English system. A survey of 27 countries identified the most common problem in implementing a cross-curricular approach as stemming from teachers’ lack of confidence, with many teachers feeling ill-prepared to address themes outside of their core subjects (CIDREE 2005, 8). Other problems clustered around embedded school cultures, ways of working and management structures (CIDREE 2005, 9–10). Attempts to focus on cross-curricular themes appear to deflect teachers’ attention from their own subject cultures rather than allowing them to apply their subject knowledge to a broader topic, although the opportunity to develop one’s subject and teach others about it is high on the list of most teachers’ job satisfaction (Spear, Gould, and Lee 2000, 52).

Concerns about the impact of narrowly interpreted curricula and ‘teaching to the test’ have led Ofsted (the schools’ inspectorate in England) to design and implement a new inspection framework. This framework specifies aims for curriculum teaching: to help students acquire both substantive knowledge (knowledge within each discipline) and disciplinary knowledge (knowledge about disciplines, and how disciplines work) (Counsell 2018; OFSTED 2019).

At about the same time as Ofsted was preparing to publish and implement their new inspection framework, a new project in schools and teacher education began called the Epistemic Insight Initiative (www.epistemicinsight.com) (Billingsley and Hazeldine 2020).

4. The context of the present research

The first stage of this research was developed as an interview study with 10 tutors (teacher educators) from six English universities. The interview schedule is presented in Appendix A in the online supplemental materials. The aim of the interviews was to investigate tutors’ views on teaching epistemic insight (EI) to pre-service teachers on their courses. More specifically, the interviews aimed to:

- identify tutors’ understanding of EI;
- establish in what ways and to what extent EI featured in existing teacher training programmes;
- find out what barriers to implementing EI in teacher education programmes were envisaged by tutors.

In addition, we wanted to find out what recommendations tutors could offer to overcome barriers preventing the teaching of EI and associated pedagogies. As a result of this

project, we wanted to identify examples of good practice that could be shared to prompt more tutors into engaging with new pedagogies in schools to mitigate the effects of entrenched subject compartmentalisation.

A year later, a follow-up survey was distributed by email. The aim of this survey was to examine changes in attitudes to EI, the level of understanding of the terminology of substantive and disciplinary knowledge, as well as the extent to which teacher educators intended to add EI strategies into their teaching.

5. Methodology

5.1. Participants

Ten tutors on teacher training programmes from six publicly funded universities in England participated in the study. Two of the universities were in the north-east, one in the west and three in the south-east of England. Of the participants, five taught on secondary education programmes two on primary programmes and three across primary and secondary. Five specialised in science education, one in art, one in religious education (RE) and one in English. Nine out of ten tutors were educated to doctorate level. Seven were male and three were female.

Participants were selected from our network of contacts. The comparatively high proportion of specialists in science education involved reflects our research centre's background in this area.

The tutors were assigned pseudonyms as presented in [Table 1](#).

The interviews were carried out by one researcher (the second author of this article).

Sixty per cent of participants subsequently collaborated with us as a part of an Epistemic Insight Initiative project. Of these, three were focused on secondary education (art, science and RE), two were in primary and secondary (science) and one in primary (history).

5.2. Data collection

Participants responded to emailed invitations outlining the aims and methods of the study and providing brief information on EI. Participants were offered a choice of conducting interviews face to face, by Skype or by telephone. The interviews were audio-recorded and lasted between 37 and 96 minutes. Participants were informed that the interview would be recorded, transcribed and analysed. Participants were assured that no real names would be used and were advised that they could withdraw from the study at any time. As one of this study's interview aims was to ascertain the extent to which tutors discussed EI with trainees (using this or other terminology), the interview began with an exploration of the tutor's understanding of the concept of EI, and participants were provided additional context and information where necessary.

The audio recordings were transcribed mostly in full, with the omission only of small sections of conversation that had little direct relevance to the research study.

The follow-up survey data was collected via email. The same tutors were contacted and answered the question described in the data analysis section below.

Table 1. Tutor interviews: the participants.

	Tutor's pseudonym	Tutor's university code	Phase of ITE most involved in	Date/length of interview (in mins)	Type of interview
1	Lawrence	A	Secondary (Art)	15.05.19/59'	Face-to-face
2	Nathan	B.	Secondary (Science)	05.06.19/62'	Skype
3	Patrick	C.	Primary & Secondary (Science)	12.06.19/96'	Telephone
4	Maureen	C.	Secondary (Science)	11.07.19/50'	Telephone
5	Lorraine	D.	Primary & Secondary (Science)	16.07.19/52'	Face-to-face
6	Lucy	D.	Primary	16.07.19/47'	Face-to-face
7	Michael	E.	Primary	19.07.19/37'	Telephone
8	May	E.	Secondary (English)	25.07.19/63'	Telephone
9	Martin	F.	Secondary (RE)	07.08.19/50'	Telephone
10	Ryan	F.	Primary & Secondary (Science)	15.08.19/50'	Skype

5.3. Data analysis

The transcripts were coded and analysed thematically using an adapted version of the recursive six-stage process developed by Clarke and Braun (2014).

This involved a familiarisation step with the data and the identification of potential interest topics followed by the generation of initial descriptive codes. This allowed for points of interest related to the research questions to be established and subsequently gathered into themes. These were then reviewed, and overarching themes identified and analysed. Themes were characterised according to perceptions and experiences (King and Horrocks 2010).

This process involved a combination of deductive and inductive coding: deductive coding was generated by identifying points of interest and themes determined by the study's research questions and the interview questions; inductive coding was generated by identifying recurrent concepts and topics in participants' responses independently of the research questions and interview schedule. Fragmenting and then reconstituting the data into a new framework in this way offered a way to lessen researcher bias and therefore allowed for a more objective account (Charmaz 2006).

Finally, follow-up questions were sent via email a year after the initial interviews, and the answers analysed. The attitudes of the tutors involved were then compared to our initial findings. As some of the tutors have been involved in EI as part of the consortium of collaborating higher education institutions, knowledge of EI-related activities in their respective institutions was also taken into account during the analysis.

The survey questions were as follows:

RQ1: What are tutors' understanding of epistemic insight (EI)?

RQ2: In what ways and to what extent does EI already feature in tutors' teacher training programmes?

RQ3: What are the obstacles envisaged by tutors in implementing EI in teacher education programmes?

RQ4: What recommendations do tutors have for overcoming the obstacles they envisage in implementing EI in teacher education programmes?

The follow-up survey consisted of the following questions:

RQ5: How has your attitude to the importance of epistemic insight in school education changed, if at all?

RQ6: Please choose your level of agreement with the statement ‘I am familiar with these terms’.

RQ7: Please put these factors in order in terms of influencing your attitude – and add your own if you’d like to: 1) Working with or in the Epistemic Insight Initiative; 2) Ofsted’s new inspection framework; 3) Our curriculum is addressing the value of multidisciplinary approaches to addressing the problems created by Covid-19; 4) Incidental factors such as reduced time or staff for teaching.

6. Results and discussion

6.1 Results and discussion arising from the initial interviews with tutors

6.1.1. Tutors’ understanding of EI

Tutors varied considerably in their understanding of epistemic insight and their perceptions of its relevance to their own work and the school curriculum.

Lawrence, a secondary tutor, was the only tutor based at an institution where teacher training explicitly included EI, yet even he was concerned that there was a ‘deficit’ in students’ understanding of EI and that most students would be unable to explain ‘what knowledge type they are studying’ or to identify its ‘benefits and limitations’. Maureen, also a secondary tutor, recalled having seen the concept described as ‘knowledge about knowledge’ but commented that this ‘doesn’t really mean anything to me’. In her view, discussions around ‘big questions’ were perceived as an ‘indulgence’ by schools and were only used to stimulate interest when introducing a new topic, so that attention to EI was only cursory.

Lawrence was one of several tutors who described EI as a way of thinking about knowledge, facilitated by cross-curricular teaching, whereas May, another secondary educator, described EI as ‘a philosophical knowledge based around epistemology . . . everything about the nature of knowledge’. Patrick expressed a similar idea, with EI relating to what we want and expect our students to know about the nature of knowledge, in association with curriculum disciplines, whereas Lorraine understood epistemic insight as developing students’ agency as learners and enabling them to critically reflect on how knowledge is constructed and tested in different disciplines.

6.1.2. Pressures and barriers that prevent teaching and learning about epistemic insight

Several tutors referred to time pressures as limiting what their courses covered. Patrick decried what he identified as a current trend in education to place an emphasis on quantifiable test results and ‘metrics’. However, he did acknowledge there are

opportunities for trainees to research an EI-related topic in the form of a self-directed research component in both primary and secondary teacher training.

Martin, a secondary tutor, was among the interviewees who said that they did not have a good understanding of EI. He acknowledged that this was a potential gap: 'maybe I should be doing something on it . . . maybe I'm not giving my training students the tools'.

Patrick referred to a survey study carried out by the UN that 'showed that English children are amongst the unhappiest in the world'. In Patrick's view, part of the reason for this is that education in the UK is approached in 'a very un-epistemic way'. 'The more we can get children thinking about that wider approach', Patrick commented, 'the better.'

Overloaded teacher training courses together with associated lack of available time to introduce new content or methods were the factors most frequently cited as the reason for not including EI within existing curricula. This problem was felt to be especially acute in the Postgraduate Certificate in Education (PGCE) course, an intensive one-year (full-time) course for postgraduates leading to qualified teacher status that forms one of the main routes into teaching in England, Wales and Northern Ireland. This course accounted for much of the tutors' teaching workload and was generally seen as already being 'too full', with no room for more content. The following comment by May is representative: 'we can't squeeze absolutely everything into that initial teacher training . . . I'm aware of how little time there is'. Patrick, who strongly supported the integration of epistemological approaches into teacher training courses, pointed to the fact that the PGCE course is 'nine months in which two-thirds is spent in school' and schools expect that the arriving newly qualified teachers will be 'fully polished'. He stressed that 'the real tension is time' and that overloaded curricula result in 'a sense of almost panic among the students'. Nathan echoed this concern, commenting that trainees are 'too busy surviving'.

In comparison, bachelor-level teacher education programmes, running for three years (full-time) were felt to allow greater time and flexibility for teaching EI. Michael, a primary tutor, commented that this was where EI was already present at his institution, with 'a couple of modules which are really based on cross-disciplinary approaches', but that the introduction of such modules in the more intensive postgraduate programmes is 'much more problematic'. Even in the latter, degrees of difficulty were highlighted, with Michael reporting that he saw more opportunities for EI inclusion in the primary than the secondary education programme.

6.1.3. A domain-specific approach to teaching

Several tutors reported that current thinking and practice in education approaches teaching along 'domain-specific' divisions. Patrick remarked that 'the strong push at the moment' was to view subject pedagogies as being distinct from one another, e.g. that 'the pedagogy of geography is different to the pedagogy of chemistry or the pedagogy of English'.

There was no consensus on the value of this approach. Some tutors stressed the benefits of a broader approach, with Patrick endorsing a 'domain-general' approach to teaching: 'I think there are cross-domain skills, so things like critical thinking, creativity, problem-solving . . . but the policy framework is not pushing that'. Others were concerned that general approaches failed to account for the differences in subject focus, with May identifying 'generic pedagogical strategies that people try and place across all subjects' as 'a big threat to education'. She identified her own discipline, English, as

being one particularly ill-served by this approach, which often imagines knowledge ‘as a goblet that can be transmitted’. Her concerns about the loss of subject-specific pedagogy were echoed by Lorraine, who was sceptical about allowing more time for discussion of EI in teacher education courses, because she saw this as posing a threat to existing pedagogy:

There is a place for it [EI] and there are some things that can be dealt with and approached in that way. My concern is still those subjects have specific pedagogies that need to be addressed and I think that’s really important.

At the same time, Lorraine expressed a view about the desirability of greater dialogue and ‘joined-up-ness’ among subject departments in schools, on the grounds that ‘science doesn’t work in isolation, maths doesn’t work in isolation’. This approach was shared by May, who expressed an interest in introducing ‘more philosophical content into the English curriculum’, specifically ‘exploring how we come to understand something, come to know something, and how stable that knowledge base is’.

This highlights the importance of distinguishing between interdisciplinary pedagogical approaches and cross-curricular learning from EI. Whereas general approaches to pedagogy and cross-curricular learning were identified by May as a threat to her subject, epistemological approaches (‘exploring how we come to understand something’) were considered to enable students and trainee teachers to appreciate what is distinctive about a given discipline and to deepen their approach to teaching and learning in their discipline.

6.1.4. Pedagogy and substantive knowledge at the expense of epistemological approaches

There was a strong feeling among interviewees that teacher education programmes focus on a pedagogy to the exclusion of epistemological approaches to learning and teaching. Patrick strongly expressed the view that there is a ‘content-knowledge thrust ... at the moment’ and that ‘content knowledge is being pushed quite strongly compared to the pedagogic knowledge’. Maureen, a secondary tutor, recommended making more links between ‘the pedagogy and the knowledge construction and taking that into the subject areas’, suggesting that tutors who teach both areas are more likely to make the links more explicit to their trainees than those who teach on only one strand, because of their own greater focus and knowledge. The only tutor who did not share this view was May, who considered that in her department both aspects were treated equally.

6.1.5. Space for EI in course assignments

Interviewees described course assessments as being divided into two categories: ‘nuts and bolts’ assignments, focusing on subject content, practical classroom skills, strategies and techniques, or small-scale research studies in an area of the student’s choice. Notably, only one university did not seem to have any kind of research-type assignment as part of its teacher training courses, and the two tutors from this university saw little to no scope for including work on EI in their courses, despite acknowledging its value.

Two tutors observed that some assignments focus almost exclusively on pedagogy. Nathan, a secondary tutor, commented that ‘teaching is very instrumental these days ... there’s very little emphasis on subject knowledge. It’s all to do with techniques and tips

and pedagogy.’ Relaying feedback from his trainees, Patrick, both primary and secondary tutor, said: ‘I hear less and less of schools doing more topic thematic-based work. Maths and English sit there as those core drivers, and other stuff simply slots in around that – it actually makes you very worried.’

Three tutors reported that there was scope within their departments’ assignment structure to incorporate some sort of research on EI or a cross-curricular topic, should a student wish to do so. However, two acknowledged that this was not an approach commonly taken by students, with Ryan, a secondary tutor, reporting that the previous year none of his trainees had done so. Furthermore, both acknowledged that there was no prompting from the tutors to do so, but instead ‘we probably pushed them down a subject route’ (Ryan). Similarly, May, also a secondary tutor, considered that this was an aspect of the course where the department did have the scope of working across the curriculum, but did not currently do so.

6.1.6. Schools driving teacher education

Interviewees emphasised the effect of schools on the content of their programmes. This is a direct consequence of a shift from ‘knowledge model’ to ‘a practice model’ (Hargreaves 2011) and the creation of ‘school-led system’ for Initial Teacher Education (ITE) (DfE 2010, 2011; MacBeath 2011; Wilkins 2015). Increased involvement of schools in teacher education through schools and HEI partnerships in England differs from other countries, where teacher education is mainly driven by university-based ITE. The influence of schools on the content of the ITE programmes was primarily described in terms of requirements or changes being driven by them, with Maureen expressing the relationship in terms of ‘keeping up’ with school teaching, while Patrick referred to course content as being generally ‘prescribed’ by school demand, with the effect that where there was no identified demand ‘then we’re not necessarily driving ourselves either’, but are guided by what he described as ‘the flavour [that] is coming out of schools’. This is an aspect that appears particularly relevant in the context of the integration of EI into programmes, especially in light of comments about the limitations of the current education system.

Criticism was levelled at the ‘exam-driven system’ currently evident in education in the UK. There was a broad consensus on this, framed particularly explicitly by Maureen’s description of schools as essentially ‘exam factories’. It was suggested that this was the reason for the content limitation and acted as a further constraint at a later stage. Even where teacher education programmes sought to introduce cross-disciplinary approaches, the practical effect would be limited. This was highlighted by Nathan, who acknowledged that while a research methods course could allow for trainees to conduct research on topics related to EI and multidisciplinary learning, once they began teaching, they would be limited by an exam-driven system in secondary schools and the mark scheme of the relevant exam board. He also noted that many student teachers, in considering cross-disciplinary courses a ‘waste of time’, only considered as ‘useful’ that which had a direct application to their classroom activities. They accepted the constraints of the education system and were not interested in developing beyond this or in bringing a broader approach to their own teaching. This could, in itself, be seen as a result of schools limiting teacher education and practice by imposing a rigid and narrow focus. It was considered that the constraints were imposed by the increasing pressures to focus on content, with Maureen assessing the potential for cross-curricular learning as ‘getting less and less’,

even at the stage of teacher training, where she described it ‘a real shame’ that ‘we don’t get the opportunity’. This is a contrast to Ofsted’s recent support for a more holistic approach to education, with its Chief Inspector Amanda Spielman commenting that the curriculum should not come from ‘isolated chunks of knowledge’ (Spielman 2018).

6.1.7. Limitations of subject compartmentalisation

Several tutors identified the compartmentalisation of subjects in schools as a factor which created challenges for them in their institutions, especially when training their students for cross-discipline teaching. It was the lack of provision for cross-discipline teaching that Martin, a secondary tutor, identified as a chief ‘weakness of teacher education’. This too was identified as a limitation caused by the schools which trainees would later join, with Martin stating that it is because the curriculum is ‘so compartmentalised at secondary’ that the structure can be described as working ‘in a silo’. Each subject has its own objectives, teachers and resources, and often there is little or insubstantial cooperation or attempts at an interdisciplinary approach (Billingsley and Nassaji 2021; Paiva, Morais, and Moreira 2019; Shefeld, Kurisunkal, and Koul 2019; Slomka 2019). ‘Big questions’ are largely sidelined in schools precisely because they do not fit into strict subject compartmentalisation; big questions tend to bridge disciplines (Billingsley 2016).

The importance of trainees’ awareness of the content of subjects they were not specialising in and did not intend to teach directly, as well as of interdisciplinary interactions, was emphasised by Maureen. In her responses, she focused on the effect of subject categorisation by schools as being both influential and harmful, arguing that knowledge is not only split into subject categories in the current model of education but that the boundaries between subjects are strongly emphasised.

However, our findings highlighted that even within this severe subject compartmentalisation, some subjects nevertheless engaged in EI, albeit not explicitly. Michael, a primary tutor, identified history as being such a subject, while noting that even where ‘some of that is going on’, it is ‘lacking in terms of multi-disciplinary approaches’.

Both Michael and Maureen believed that EI teaching should be done more explicitly. This view was also shared by Lorraine in the context of ITE teaching, though she was sceptical about the inclusion of more EI in teacher training programmes.

6.1.8. Problems noted with science teaching specifically

Multiple interviewees noted science teaching as being an area that particularly resists adding EI to its practices. Science tutors described school science curricula as being ‘very reductionist’ and ‘very narrow’. Nathan highlighted that the focus is ‘very knowledge centred’ without a broader, interdisciplinary approach to the topics raised in the classroom. He gave the example of genetic engineering, which he described as being discussed ‘from a scientific establishment point of view’. Nathan’s comments suggested that he thought science lessons in schools should focus more on broader ethical issues that are raised by such topics. A similar approach was taken by Lawrence, who stressed that this very fragmented model of science education does not adequately prepare students for a later science-based career since such careers ‘increasingly’ involve ‘having to think about wider ethical decisions’ which are neglected in a curriculum that ignores the extent to which these subjects naturally interrelate in real-world contexts.

In the same vein, tutors criticised the content and presentation of science curricula, which Nathan, a secondary tutor, described as being ‘presented as a corpus of facts’, even where the so-called ‘facts’ no longer represented the primary approach among specialists. He gave the example of genetics, where he commented that curricula described genes as being ‘like beads of DNA on a chromosome’ despite ‘geneticists [not] believ[ing] that anymore’. Subject content was further criticised as being presented uncritically, without consideration of the ‘assumptions built into the techniques’ used to collect the evidence (e.g. microscope and genome sequencer), so that there is instead a tendency to portray science subjects as more rigorous and the knowledge as essentially objective. This extended even to the field of teaching science, with Ryan commenting that he often encountered secondary trainees who were anxious to be taught the ‘correct’ way of teaching science and struggling to identify that there was not a specific correct approach.

Tutors report that this search for apparent objectivity and the ‘right’ approach is accompanied by a dismissal of knowledge and subjects that devote more time to discussion and subjectivity. Martin, a secondary RE tutor, reported that ‘science teachers are dismissive of the RE teacher’ and that ‘other teachers’ more broadly think of his specialisation as not being ‘a valid area of study’. Ryan, a science tutor from the same university, agreed that this approach was prevalent in the view that ‘what’s not scientific method is, therefore, baloney’. Even within a narrower subject focus, this preference for what trainees interpreted as objectivity was reflected in the marked preference for quantitative data which Ryan noted among his trainees, some of whom required ‘a journey’ to accept qualitative data as a valid basis for discussion. Under such circumstances, the introduction of EI into the programme of study is hindered by an over-reliance on a narrowly interpreted range of useful information. This being so, it is not surprising that tutors report that trainees are often resistant to engaging with multidisciplinary approaches, with Nathan reporting that cross-discipline sessions are ‘always poorly reviewed’ and described by students as a ‘waste of time’. However, while the present rigidity and narrowness of focus make the introduction of EI into programmes more challenging, trainee teachers’ responses provide evidence of the importance of the introduction of EI into teacher education, as the narrow focus is not beneficial to development and understanding.

6.1.9 The block caused by ‘big’ philosophical words

Several tutors identified ‘big’ philosophical words as inhibiting trainee teachers’ comprehension of and engagement with EI.

May, a secondary tutor, raised concerns about introducing philosophical concepts too early to trainees, suggesting that it might be more advisable to leave such concepts to postgraduate Masters or PhD-level courses. However, she acknowledged that epistemological questions do arise in subject courses in the context of discussion like ‘what is subject knowledge for English?’ or ‘what is truth in History?’ but these questions are not couched in such philosophical terminology. Lorraine, a primary tutor, expressed a similar idea, believing that putting ‘something called epistemic insight onto a lesson plan’ would cause ‘panic’. Here again, the issue of schools acting as a limiting factor for teaching education programmes arose, with Lucy, a primary tutor, expressing reservations at the use of the terminology, on the grounds that it does not form part of the ‘language’ used in schools and may not be recognised by head teachers and other interviewers, unlike the plainer language of a ‘broad and balanced curriculum’, which has become a well-known

phrase associated with the government's Office for Standards in Education (Ofsted)'s 'Education Inspection Framework' (2019). Her understanding of this 'breadth and balance' is here discussed as EI, though her focus on 'making those links between the subjects' was something she stressed in the context of the primary curriculum rather than the whole-school education period (it is possible this was due to her role as a primary education tutor).

This 'fear' of EI terminology and theory forms part of a broader tendency regarding attitudes towards the theory of education. Patrick observed that trainees were being told by school mentors that theories of education taught at university held little practical value in the classroom, with training to become a teacher primarily a 'school-centred model' with the teaching viewed as an 'apprenticeship'. While the cross-disciplinary approaches may be introduced without being sign-posted, it is more difficult to measure changes if terminology is avoided.

6.2. Recommendations for implementing epistemic insight in teacher education

While there was a consensus about the importance of EI as a concept and the need for its inclusion in ITE courses, tutors were reticent to place additional content in their curricula. There was greater appetite for the integration of EI into existing programmes and modules, with tutors whose courses include small-scale research projects keen to explore ways for trainee teachers to conduct research involving teaching EI to children in school as a part of their assignments.

Most tutors thought that considerable resources would be required to substantially incorporate EI in existing courses. Several suggested that it would be easier to integrate EI into general courses for the whole cohort, as opposed to subject-specific courses. This is in recognition of the fact that EI intrinsically calls for cross-subject discussion.

The primary idea was for the introduction of an EI focus separate from subject education. In terms of teacher education, Maureen suggested 'specific times for subjects that mingle well together,' and Ryan similarly recommended a workshop format, as part of a series in his institution focusing on pedagogical issues. In terms of school teaching, several tutors suggested that it would be appropriate to run sessions in 'off-timetable' environments such as assemblies, clubs and school 'enrichment' days. Unfortunately, this has the effect of side-lining EI as a self-standing topic instead of engaging with interdisciplinary approaches to topics as they arise, e.g. discussing the merits and ethics of genetic engineering in a lesson about genetics. This was acknowledged by May, who argued that it would be difficult for secondary schools in particular to make anything but a 'tokenistic' attempt at EI engagement, given the existing structures around which schools operate. This is a concern that was raised more generally as being a reason for the relative lack of cross-disciplinary teaching at present. She also commented that changes would require people to be 'willing to step outside their own discipline' but in relation to anything beyond short and cursory discussion, this is quite an onus to place on individual secondary teachers, who already may be struggling with limited class time.

The closest idea to a topic-based interdisciplinary approach came from Martin, who was keen to encourage trainees to design their lesson plans in such a way as to involve multi-disciplinary aspects, in so doing integrating EI into standard subject teaching. A similar, albeit more limited, idea was expressed by Maureen, who emphasised the

importance of getting trainees 'to think beyond the curriculum', with EI being one way in which they could do so. She reported that a new initiative at her university entailed an activity day where trainees had to do something 'beyond the exams, to see the bigger picture', which is an approach they could then apply more broadly to their teaching. Offering an approach falling between the idea of 'off-timetable' EI and EI integration into subject teaching, Ryan explained his own engagement with 'big questions' when teaching Personal, Social, Health and Economic classes at a time when there was no standardised framework for this. He recounted how pupils frequently raised EI-related questions, such as on the interaction of religious beliefs and science, which allowed for an engagement with EI because students were interested in exploring 'seemingly two contrasting ideologies' and how these could interrelate. However, he commented that these discussions were of a 'very fluid' nature and recommended a more structured approach explicitly requiring students to engage with EI to consider 'alternative viewpoints [and] actually wrestle with those alternative viewpoints to inform why you have your own epistemological beliefs system'. While this represents a greater integration of EI than the 'off-timetable' approach, the focus here is still on relegating such multidisciplinary approaches only to one particular timetable slot, rather than examining the interactions with other fields as topics arise. The impact of this approach is that strict subject content separation remains in place and access to EI across and between disciplines remains limited.

There was a unanimous call for greater resources in teaching EI, whether within specific subjects or more generally applicable across classrooms. It was felt that the current provision of EI-related resources was lacking, or non-existent. Several tutors commented that until recently they were not aware of any resources that would help them to teach EI, with Maureen commenting that she had actively searched for websites providing cross-curricular materials and found very little available. However, tutors expressed a reluctance to develop such resources themselves, stressing lack of time. Michael reported enthusiasm among the staff at his institution at the idea of including more EI approaches in trainee programmes. However, this was contingent on them determining a good working model to follow, by having 'an example of how other people have approached this', which 'we can mirror'. This reflects the rather rigid approach to teaching models that were identified in trainees focusing on science subjects in particular, as discussed above, and this follower-model forms a barrier to change. However, even this more rigid approach could be utilised in encouraging multidisciplinary relationships. Ryan reported that existing pedagogy workshops bringing together trainees from different disciplines are 'really valued', and something similar could be employed to an epistemological rather than pedagogical focus. His assessment was that teacher education programmes at present approach pedagogy and epistemology very differently, with the use of different pedagogical approaches being assessed and rewarded in a way that different epistemologies are not. It follows, therefore, that a change to assessment criteria that encourages a range of epistemologies and multidisciplinary approaches could serve to encourage a greater consideration of EI among trainees, with a corresponding effect on later teaching. Moreover, it has been shown that proper support for interdisciplinary teaching can improve abilities to create activities connecting multiple disciplines (Song 2017). Therefore, it is likely that a greater emphasis on interdisciplinary approaches in university

courses and training will better equip trainees to include these elements in their own future lessons even where school assessments do not explicitly focus on this aspect.

It was recognised that the current format of postgraduate teacher training courses allows tutors and universities little room for introducing significant changes. Almost all the tutors interviewed bemoaned the fact that courses are only a year long, with most of the trainees' time being spent in schools rather than on university courses. This makes it difficult for tutors to introduce broader interdisciplinary approaches, or indeed any significant changes, given that they are working within a small period of tutoring time. Several explicitly called for the PGCE to be made a longer course, extended to two years. Maureen commented that trainees 'struggle to make the connection' between what is taught in their theory sessions and what they study in their subject methods sessions. She considered that the links between the two would be facilitated by a greater inclusion of EI, specifically by having it be 're-visited frequently throughout the year'. The benefit of EI inclusion was agreed on by Patrick and May, especially in the context of potential long-term impact. Patrick remarked that the issue with English teacher education was not recruitment, but retention. A more interdisciplinary approach would have the benefit of making subject teachers more conscious of being part of a broader educational context, which may contribute to making their work more fulfilling.

The majority of tutors observed that explicit teaching of EI was unlikely to be introduced in their institution unless this was incentivised. This was a consequence of the role of schools in guiding teacher education programmes. Maureen stressed that the focus of schools fell on grade attainment, and so incorporation of EI into lessons was unlikely without significant incentives. Accordingly, she thought that if the government sought to bring in greater cross-curricular teaching, guidelines would have to specifically require EI. While Ofsted now calls for teaching to be 'broad and balanced' (Richards 2019), an aim which lends support to an interdisciplinary approach, lack of specific and detailed guidelines as to EI remain.

6.3. Follow-up survey: changes in attitudes to EI

Based on our research findings discussed above, we developed a plethora of resources aimed at helping tutors teaching on the Initial Teacher Education (ITE) programmes to introduce EI into their courses. Of the 10 tutors initially interviewed, seven became further engaged with EI and began to embed epistemic insight into their courses through the Epistemic Insight Initiative (www.epistemicinsight.com). This occurred within a context of significant changes in education in England, prompted by a new framework from Ofsted introducing the term 'disciplinary knowledge' (Ofsted 2019) to encourage schools to teach about disciplines and not only the knowledge they produce, as a call to move beyond a limiting interpretation of subject curricula, particularly in science.

An interest in how tutors' involvement with the EI Initiative and the broader shift towards a more holistic approach to schools and the curriculum influenced their attitudes to epistemic insight and its implementation into the ITE programmes prompted a follow-up consultation with previous interviewees.

Nine follow-up responses were received.

All survey participants were familiar with new Ofsted framework, and the terminology of substantive and disciplinary knowledge (RQ 6). In general, EI inclusion in training courses had

increased. In some cases, this was a matter of refining pre-existing interdisciplinary aspects. Lorraine, a primary tutor, said that she had 'always explored the notion of what we know and how we know it and considered this in relation to science and other areas', but only now had made EI a more 'conscious and explicit' part of her teaching.

Some tutors reported having developed a greater theoretical understanding and appreciation of EI. This was the case irrespective of their initial understanding and knowledge of EI, as exemplified in the responses of Lawrence and Martin (both secondary tutors). Lawrence had come into the initial study with a good knowledge of EI but described himself a year later as 'more attuned to the importance of developing both substantive and disciplinary knowledge for pupils'. Martin, a secondary tutor, who acknowledged that he did not have a strong understanding of EI, has since become engaged with the Initiative as a collaborative partner, delivering Saviour Siblings workshops (Sossick 2020), reported that his 'attitude to the importance of epistemic insight has increased' and that EI has become something he 'really values'. Likewise, Ryan, another secondary tutor, reported that his involvement with the project has 'significantly changed' his perceptions and attitudes towards EI: specifically, that he previously focused on the importance of developing scientific skills and scientific literacy, but now he also highlights the limitations of science and how other subjects take different approaches to similar topics. Ryan described the example of the bridging disciplines while exploring the sinking of the Titanic, employed in LASAR workshops, as having been 'eye opening' for his understanding. This is one example of the newly created resources aimed at the encouragement of EI in classroom contexts. A similar experience was reported by Patrick, a primary tutor, who also declared his intention to use EI Initiative resources (specifically essential experiences cards) in his teaching.

Greater inclusion of EI in training courses was reported by several interviewees. Michael's institution already offered some courses 'based on cross-disciplinary approaches' but have now become more aware of 'the importance of addressing epistemic insights'. This HE institution is now running a third-year BA module pairing subjects to look at a common theme. Neil reported that he has incorporated 'big ideas' into his PGCE science workshops and is launching a website specifically targeting middle-years biology which will explore some of these epistemic issues, aiming to encourage more interdisciplinary teaching. While neither May nor Maureen has substantially changed their approach or inclusion of EI, this has been credited in a large part to the interruptive impact of the pandemic.

Follow-up interviewees assessed EI as highly important, and a significant number expressed a desire to collaborate further with the EI Initiative. Seven of nine interviewees put this intention among their high priorities, four as the first and three as the second. Those placing further collaboration with the EI initiative as second highlighted a need to address the problems created by the pandemic. Overall, the importance of further EI integration was recognised and rated as important by interviewees.

7. Conclusions

This study focused on researching what a small group of university tutors had to say about the ITE courses they teach at their universities, their perception of EI, the extent to which EI features in their courses, and their suggestions as to where and how EI could be embedded. The 10 tutors shared their insights on trainee teachers'

familiarity with the nature of knowledge and scholarly enquiry. Additionally, the tutors provided valuable insights into teachers' perceptions on the areas of our research owing to their previous careers as teachers, and their observations or conversations with teachers.

The study found a broad consensus about the importance of EI as a concept, and the desirability of the inclusion of EI in ITE courses; however, barriers to such inclusion were also presented. Tutors were unanimous in reporting that EI was not adequately addressed within their institutions. Key barriers to greater EI integration into teacher education included the demands and expectations of the current education system including its rigid subject compartmentalisation, and the lack of knowledge of (and reluctance to involve) a multidisciplinary approach. Barriers were compounded by the limitations placed upon teacher training course timetables owing to the emphasis on school placements. Most tutors suggested that there was significantly more scope in primary than in secondary education to address multidisciplinary EI approaches owing to specialist subject curriculum teaching on the latter programmes. Primary teachers are by nature more of 'generalists' rather than subject specialists, and many primary curricula are a blend of high-quality subject teaching and cross-curricular learning. This is often achieved through theme-based learning or a project-based learning, as has been demonstrated both in England and internationally (see, for example: Boyle and Bragg 2008; Boss and Larmer, 2018; Hasni et al. 2016; Lee et al. 2014). It was thought that inter-disciplinary and multi-disciplinary pedagogy, often occurring in primary schools, might be a more 'friendly' environment for embedding epistemic insight in their curricula.

Follow-up research after a year has shown that those tutors who were involved in the Epistemic Insight Initiative had a greater appreciation of EI as a concept and began to embed epistemic insight into their modules. This cohort constitutes 70% of the initial respondents. However, the importance of multidisciplinary approach is still not widely understood, and key concepts and strategies need to be further promoted and explained. Tutors who have engaged with our work have gained a richer understanding of the nature of disciplines and how they interact and have begun embedding epistemic insight concepts into their teaching. However, while the continuing engagement with these tutors is encouraging, this cohort constitutes only a small proportion of ITE educators. Further work is necessary to support teacher educators who currently have only a limited awareness of, or engagement with, multidisciplinary education; this work is needed to encourage the greater inclusion of interdisciplinary approaches in education as a whole. Given the increasing focus on holistic approaches to facilitate a broader and more balanced education, promoting and supporting epistemic insight in initial teacher education programmes is of great importance. This approach is vital to developing teaching and learning that enables young people to be future-ready and should be a priority for teacher training and continuous professional development for teachers and teacher educators.

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