The legacy of Verena Holmes: inspiring next generation of engineers

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The Legacy of Verena Holmes - Inspiring the Next Generation of Engineers

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Introduction

Scientists and engineers over the years have worked to produce innovative inclusive products. As educator how to nurture the next generation of inventors for various industries? Verena Holmes is one woman who has been and continues to be an inspiration to up and coming female engineers. This poster seeks to address her impact in influencing students to be innovative by improving on one of her inventions: the poppet valve (Holmes, 1931), through survey. It also seeks to investigate the impact of the practice-based pedagogy approach on student learning. Six reports were analysed to determine how:

- students instrumented their learning in practice to test concepts
- whether what they learned matched the intended learning outcomes
- in-depth student learning
- significant inspiration activity has upon the next generation of engineers

Pedagogy Evaluation Method

Effective pedagogy needs to be evaluated in line with the goals of the society it is meant to serve (James & Pollard, 2015):

- Engages with valued forms of knowledge.
- Recognises prior experience and learning.
- Requires learning to be scaffolded.
- Needs assessment methods support learning.
- Promotes the learner's active engagement.
- Fosters and promotes individual and social processes and outcomes.
- Recognises the importance and significance of informal learning.
- Depends on the learning of all those who support the learning of others.
- Learning framework that supports learning.

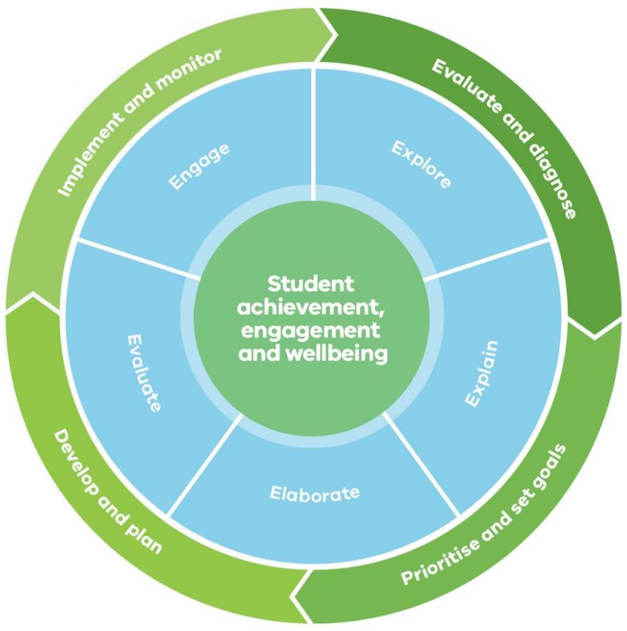


Figure 1: The pedagogical model (DET, 2000)

Background

This poster provides a qualitative analysis of the level of practical engineering learning and the depth of student learning. Also, the quantitative analysis of students' evaluations of the learning opportunity in inspiring, developing and stimulating them to be the next generation of engineers.

Firstly, some background, Verena Holmes who was a renowned first UK female mechanical, design and biomedical engineer (WES, 2014). She was a strong advocate for female participation in the field of engineering. She was responsible for the design of one of the most useful devices in the field of engineering today: the poppet valve (Holmes, 1982).

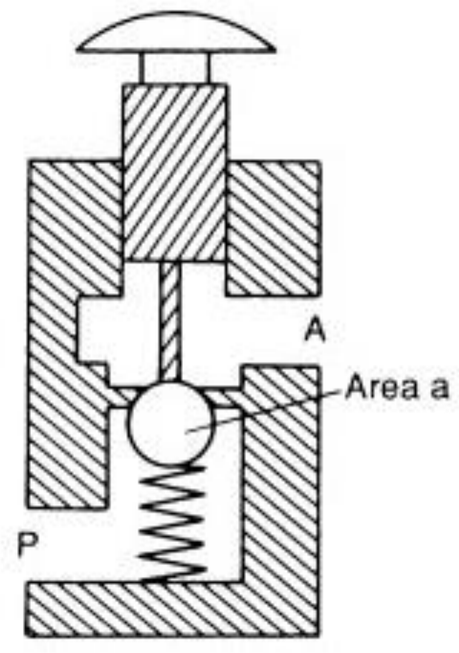


Figure 2: An example of a 2/2 normally closed poppet valve (Parr, 2011)

As seen in Figure 2, is a simple poppet valve. When the actuator is pushed down, fluid is allowed to flow from port P to port A, (Parr, 2011).
Students were challenged to design their own poppet valve. This entailed considering industrial practice;

- Standard components; spring and nut and washes
- Materials and material selection
- Design for manufacture and manufacturing processes

Case Study Observations

A summary of each case study is given below.

- **Case study 1:** Research was detailed and technically focused. **Case study 2:** Some research went into the history of the poppet valve, but mainly focussed on the product design.
- **Case study 3:** The students acknowledged Verena Holmes in their work. As for the technical aspects, focused on why certain components had to be outsourced and not 3D printed.
- **Case study 4:** The inspiration behind Verena Holmes' work was apparent in this report and their understanding of the operation and application of poppet valves. The students chose to CAD design a spring-loaded poppet valve, manufacture using laser cutting technology and 3D printing.
- **Case study 5:** This report had a more comprehensive description of poppet valves, their operation, and their main application, lacked product's history or its inventor, very technical focused report.
- **Case study 6:** This report touched on all the key aspects of the assignment, including an acknowledgment of the designer and the fact their design was based on Verena Holmes poppet valve.

Overall, the students were successful in addressing the technical issues presented in this assignment and working together developed their employability skills.

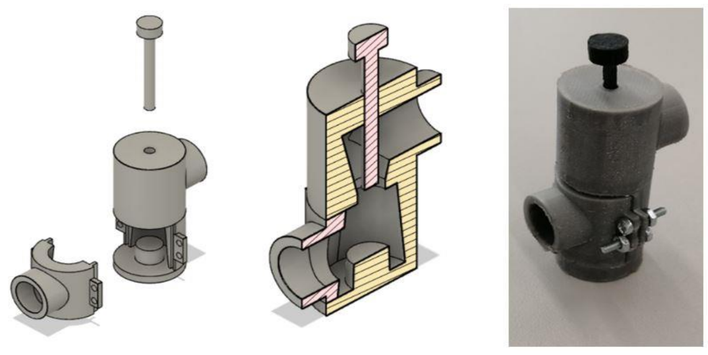
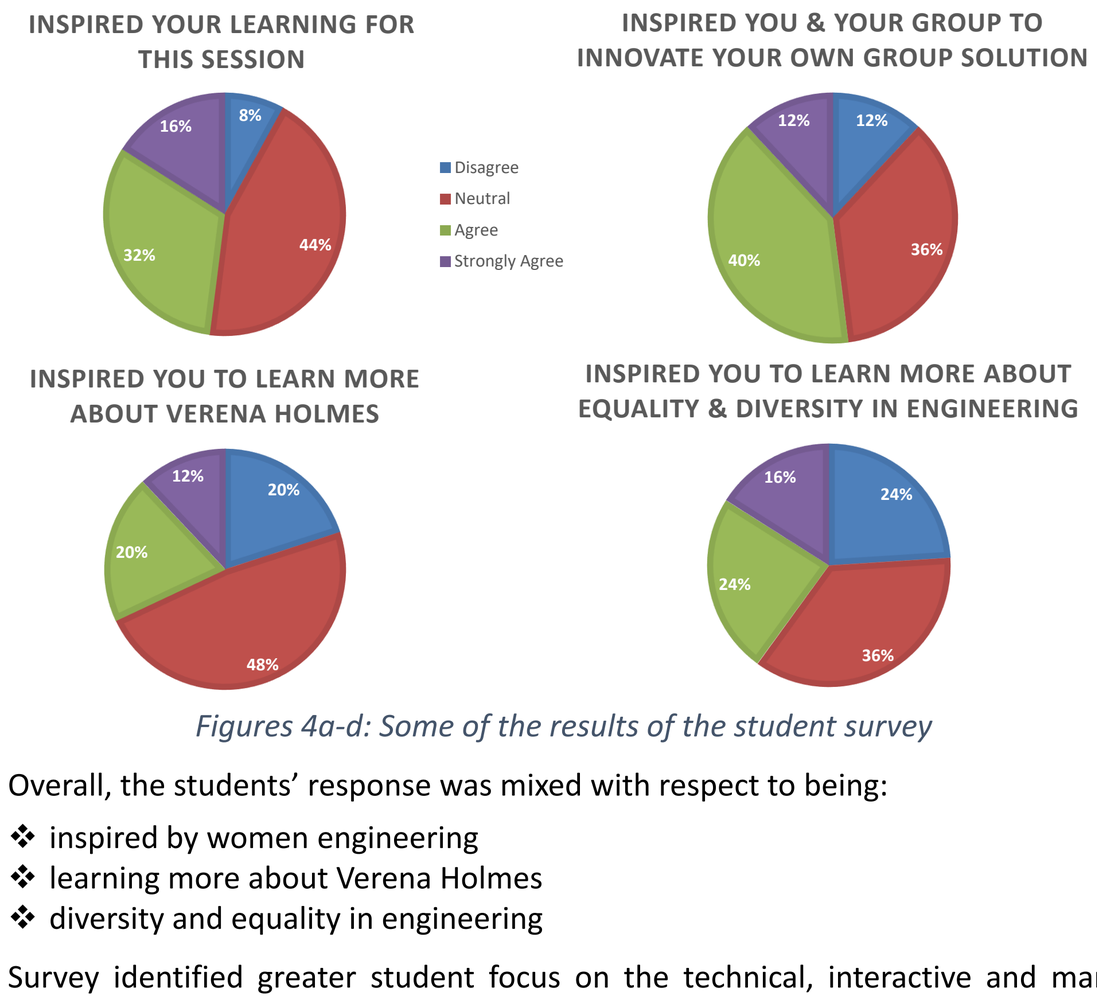


Figure 3: The poppet valve designed on CAD and the final product made using rapid prototyping

Student survey

A survey was carried out to understand impact of the pedagogy activity inspiring the next generation.



Figures 4a-d: Some of the results of the student survey

Overall, the students' response was mixed with respect to being:

- inspired by women engineering
- learning more about Verena Holmes
- diversity and equality in engineering

Survey identified greater student focus on the technical, interactive and managerial learning aspects. The student learning the engineering traits for employment as an individual and as a team, and less on environment, security, diversity and inclusion.

However, the overall skills learning is in line with the AHEP 4.0 standard, but there is need to improve inclusion and diversity learning. As the students will face working in diverse environment and some students may need more help than others (Long III, 2016).

Conclusions

The overall feeling about the session among the students was positive. It is also clear that the issue of diversity and inclusion will need to be discussed with students. Perhaps the overly technical nature of the assignment did not cater for the opportunity to discuss these issues, as students were evidently keener on completing the assignment and having a finished product.

References/Acknowledgements

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