Do different learning contexts, processes and environment affect perceptions, dispositions and approaches to learning?

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Abstract

As student perceptions and approaches to learning are fundamental to both outcome and experience it is important to understand how they are influenced by learning context. This research has begun to develop an understanding of these aspects of two mechanical engineering programmes through the use of a questionnaire at levels 4 and 5. Although there was much agreement between the cohorts, some significant differences were identified which could be considered by programme teams during the design of teaching innovations.

Keywords: student perceptions, learning contexts, approaches to learning, mechanical engineering

Background

This research project sought to contribute to improvements within engineering education, specifically mechanical engineering, by examining what students do and how they perceive their learning context. Teaching and learning research in higher education (HE) in general links student perception and approach with their quality of learning and therefore it is vital that we consider this within an engineering education setting.

One aspect of education theory, which focuses on students’ perceptions of learning environments and their behaviour in context, is approaches to learning research (Marton and Saljo, 1984), based on phenomenography (Marton, 1981). Past research used qualitative methods, but a large number of subsequent studies have made use of quantitative instruments. The existing instruments make assumptions about the factors that affect or are important for student learning; however, they leave little space for emergence of new findings, especially those which may relate to a specific learning context. This research suggests that if context is important to a student’s individual approach to their learning then it is important to consider the broader approaches to learning found within an engineering setting.

The context of HE is undergoing a period of accelerating change (Fry et al., 2009), for which reason it is suggested that the changing context must be considered when examining relationships between research and teaching (Brew, 1999). Lizzio et al. (2002) describe how ‘research efforts addressing the impact of students’ perceptions can be readily framed’ within Biggs’ 3P model of learning (which proposes that personal and situational factors encourage the student to adopt a particular approach to learning which, in turn, mediates or influences the types of outcomes achieved and that presage factors (e.g. perceptions of the learning environment) can also directly influence learning outcomes).
Benson and Samarawickrema (2007) explain that the context of teaching and learning may include a range of factors ‘from the specific characteristics of the learning and teaching environment, to disciplinary, institutional and systematic variables, and beyond that to broad social influences and personal issues affecting students’ lives’. Gow et al. (quoted in Hall et al., 2004) and Sharma (quoted in Hall et al., 2004) also found several variables which influence students’ learning approaches, such as workload, the nature of assessment tasks, teaching style, staff:student ratios, the structure of the course and lectures, enthusiasm of lecturers and tutors, generation of a personal learning context and provision of feedback. The questionnaire used in this study had been previously developed and evaluated for the specific purpose of exploring student perceptions within the context of the mechanical engineering discipline (Tudor et al., 2010).

This research investigated the views of 322 student mechanical engineers from two universities, one pre-1992 Russell group (N=153) and one post-1992 University Alliance (N=169), located in the same city and aligned to the same aims through their accreditation by the Institution of Mechanical Engineers. As part of a larger study into understanding how the choices we make in the way we teach impact upon and support the learning of students from diverse backgrounds and of differing motivations, this presented the researchers with the opportunity to ask ‘do different learning contexts, processes and environments affect perceptions, dispositions and approaches to learning?’

Both programmes follow a traditional structure for mechanical engineering programmes, based on the delivery of a body of knowledge founded in mathematics and engineering science which is contextualised through application in design and incorporates materials, manufacture, business and management. Delivery mechanisms and contact hours are broadly similar and range from large lectures through design classes to smaller group laboratory sessions. The assessment strategy of both programmes is based on examinations for knowledge-based content and supported by project work for skills development.

**Rationale**

*We ask do different learning contexts, processes and environments affect perceptions, dispositions and approaches to learning?*

- What are students’ perceptions within their learning context?
- What approaches are students making use of in their learning?
- How do students carry out the practice of their learning?

This deeper understanding of our current students and the impact of our teaching will allow us to design and evaluate ways in which we can best support the learning of future students from a diverse range of backgrounds and motivations.

**The methodology**

A previous study established that the experience of mechanical engineering students is an under-researched area, with engineering generally being considered as a broad discipline. This study sought a finer distinction in outcome, as anecdotal evidence from staff teaching across sub-disciplines suggests that students of the different engineering sub-disciplines approach their studies differently. In order to identify themes which would allow the work to be explored within the existing framework of scholarly work in approaches and perspectives of learning, the study adopted a “mixed methods” exploratory sequential design (Tudor et al., 2012).

The earlier study developed and validated a questionnaire which was reviewed to ensure equal suitability for both universities, ensuring that terminology etc. were either neutral or matched to context and cohort stage and making minor changes to suit the context of the second institution (for example by removing references to part-time study). At this time the opportunity was also taken to reduce the overall question count to 82 (Penlington et al., 2012). The questions used a 5-point Likert-type scale to explore the following themes: expectation of HE, approaches to learning and studying and personal feelings about experience of classes, assessments, structure and staff.

The first round of data collection took place two-thirds of the way through the academic year and the second round saw the questionnaire being deployed early in the following academic year (thus the level 4 progressing students were sampled again early in their level 5 studies). The results
therefore only identified a change in views for the collective cohort in each instance, rather than any transition of views for individuals. The questionnaires were deployed in a paper-based format to those who had agreed to participate (an average of about 65% of the cohorts involved). Data obtained were analysed descriptively using SPSS (Statistical Package for the Social Sciences), which allowed the examination of both mean and modal scores by question and by cohort.

The project also sought to employ an online tool (the Effective Lifelong Learning Inventory (ELLI)) to measure and describe change in dispositions to learning “power”. The employment of a second instrument was intended to support triangulation of results, thus contributing to the depth of the study.

This methodology was employed to enable us to confidently describe the relationship between the context of learning and students' perceptions of and approaches to it. Further experience of the use of the questionnaire in an alternate situation will support universal evaluation of a wider range of programmes or design of new programmes by facilitating understanding of how academics’ intentions regarding the learning process are reflected in students’ actual perception and engagement with it. The outcome of this will be the facility to identify less effective activities and, importantly in new programmes, the design of learning activities in which the outcomes are aligned with the students’ approaches.

**Lessons learned**

The project has been able to meet its aim and make interesting observations about the contextual influences on students’ approaches to learning. Such observations are of interest in two ways: where they show differences based on context or stage of learning and where they confirm common approaches or motivations independent of institutional context or stage of learning.

The questionnaire consisted of 82 questions under a range of headings which were most notable in terms of the degree to which most students expressed the same views, regardless of institution or level. Where differences existed, further questions could be asked. A selection of observations drawn under each heading are summarised below.

**What do you expect to get from the experience of higher education?**

- **included** When I look back, I sometimes wonder why I ever decided to come here and Much of what I’ve learned seems no more than lots of unrelated bits and pieces in my mind. These statements were universally disagreed with, regardless of context or stage of learning.

**Ways of learning**

- **- headed questions included** There are some modules that I’m aiming to just pass rather than really understand. Most respondents agreed somewhat, with the exception of the pre-1992 level 5 cohort who responded disagree somewhat, whereas I do less independent study for modules that aren’t important to me obtained the response disagree or unsure from both post-1992 cohorts but agree or agree somewhat from both pre-1992 cohorts. Another question which obtained results which differed by context but not stage of study was Last year I needed to ask my friends more about how to tackle work, which was agreed with at the post-1992 institution but disagreed with at the pre-1992 institution. This response may require further exploration of the contrast between contextual engagement in peer learning and the development of individual confidence in the learner.

An example of this is consideration of the statement I’ve put more hours into my weekly studying compared to last year where during the first deployment of the questionnaire both cohorts at both institutions agreed that they had put in more hours than during the previous year. That all students held the view that their second year of study was more time-demanding than their first (or interestingly their ‘A’ level year) was reinforced as a universal perception by the fact that the students who had agreed with this statement at level 4 agreed more strongly when they reached level 5.

A summary of results where contrasting views were obtained is shown in Figure 1.
Figure 1. Modal score differences by institution

Through the questionnaire, the project was able to draw conclusions from 322 students balanced between the two institutions, the majority of whom were studying at levels 4 and 5. The participating researchers were surprised by the degree of agreement in 70 of 82 questions. It must be remembered that agreement may be a positive outcome of the research, even if it only confirms a uniformity of practice in mechanical engineering departments. Fortunately there were some positive confirmations, such as agreement that modules become progressively more difficult year by year and strong agreement with statements which suggest a commitment to the broader benefits of HE (e.g. I hope the things I learn will help me to develop as a person and broaden my horizons and, in terms of the broader role of engineering, I want to learn things which might let me help people, and/or make a difference in the world).

This success was contrasted by a significant failure to engage students, even in small numbers, with the online ELLI instrument, which resulted in no results being available. This was of interest to the researchers as it offered the incentive of a personalised study profile to the students, whereas questionnaire completion was only rewarded by a chocolate bar. We have concluded that it is the method of collecting the data and not the prospect of reward which is important, as the questionnaires were completed by the class as a whole at the end of a lecture (a relatively social setting), whereas the online ELLI tool is either accessed in isolation or requires students to make a special effort to attend a computer laboratory.

During the study the students expressed interest in the purpose of the research. Although they recognised that any outcomes (in terms of practice change) would only apply to subsequent cohorts they were still interested in being given a summary of the project outcomes.
**Discussion, summary**

An objective of this research was to ask Do different learning contexts, processes and environments affect perceptions, dispositions and approaches to learning? to which the overall response was in part. As the research sought to reduce variables by considering two programmes in the same geographical location, discipline, level and accreditation status, finding broad agreement may confirm that both programmes are equally successful in meeting the expectations of the students they recruit.

In taking a broader view, the research findings provide further evidence of accepted student views of HE but have value in their being specifically investigated in relation to the teaching of mechanical engineering within the context of two universities. Some general statements concerning learning and teaching on mechanical engineering programmes which, although not new, have been further reinforced by this study. These include:

**Students value:**

- authentic “real life” examples and teaching context
- knowing that depth of understanding is required to obtain good marks
- knowing what progress they are making through continuous assessment; marks counting towards final award reduce the fear of failure
- modules which are well organised and encourage more effort
- space and comfort in lectures, which ensure their sustained attention
- opportunities for peer learning, but also guidance on independent learning.

**Students were concerned by:**

- quality of teaching not being as expected
- perceived heavy workloads.

The findings were limited to a snapshot of current practice and therefore care should be taken when looking at various weak trends. However, responses to several questions may be seen to support the expectation that students are becoming more demanding, therefore making the more significant responses important in underpinning structured change in current practice.

**Further development**

This work contributes to an expanding interest in understanding the complex interactions between engineering programmes of study and their students. The research suggests that this is a key component in developing programmes which are not only attractive to a broad range of school leavers and meet students’ expectations, but also deliver a growing number of graduate engineers into the workplace. Attracting a diverse range of school leavers into existing programmes will not ultimately be successful without this change.

This work has looked at mechanical engineering and other studies have explored student perceptions of other engineering disciplines, for example chemical engineering (Mendes et al., 2011), or innovations applied in differing contexts (Bernhard, 2010). The researchers suggest that more work should be undertaken to explore the differing perceptions and approaches taken within engineering disciplines in order to ensure that a “one size fits all” approach is not taken.

**References**


Further reading/bibliography


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