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Realities in rhetoric of online testing: A higher education case study

This paper presents findings from a recent international collaborative research project, between a University of Applied Sciences in Finland and an Institute of Technology in Ireland, to determine how engineering students perceive online assessment of engineering mathematics in their first year of study in Higher Education. Anecdotal evidence suggests that some students believe that online assessment does not give justice to the effort or provide sufficient reward for activities. Evidence was gathered from students in the form of questionnaires and interviews and alternative perspectives were sought from lecturers in the form of interviews. Many students display low levels of confidence and perceive barriers to their study in the initial stages of their study and do not demonstrate an understanding of continuous online assessment. The study provides a brief insight into the challenges that students face in their first year of study in engineering mathematics. The outcomes suggest an alternative approach to curriculum design may be necessary to attenuate the concerns of students in the first year of study.

Introduction

A review of STEM provision in Ireland (McCraith, 2015) at primary and post-primary level raised issues concerning, transition to 3rd level, the use of ICT and international performance and comparison. Research provides evidence that similar issues are also pertinent in Finland (Kinnari, 2010; Rinneheimo, 2010) suggesting that PISA results differ from 'teachers experiences of students'.

The importance of the role of assessment and ICT is well documented within the literature. An extensive review of e-assessment, focusing on online computer-marked quizzes conducted by Jordan (2013), highlighted the increasing role of eAssessment technologies within the learning environment and how this environment may be optimised beyond simple quizzing (Johnson, Becker, Cummins, Estrada & Freeman, 2015).

This paper presents the findings from a recent research project to gather information on the conceptions and expectations that first year engineering mathematics students have in relation to online assessment and their reflections immediately following online assessment. Analysis of anecdotal observations gathered over several years, from formal and informal feedback media, suggests that many students may inadvertently experience negative behavioural attributes in advance of, or following, the online assessment. Recent research (Gallimore & Stewart, 2014; Tempel & Newman, 2014; Gill, Mac an Bhaird & Ni Fhlionn, 2010) suggests that negative attributes may be more deeply embedded resulting in the need to introduce additional mathematical support at third level.

The outputs from the research will provide an evidenced data source for discussion in the design of new programmes as they expand their online provision. The evidence will help designers frame their understanding of the effects of the technology on the learning process, examining pedagogical barriers and support, and examining how this relates to levels of interaction and engagement online.

The project was designed within a socio-cognitive theoretical framework of self-efficacy (Bandura, 1977) to help the researchers understand the experiences and perceptions that learners bring in their transition to third level engineering mathematics. The main thrust of self-efficacy theory is that the actions of the learner and their subsequent reactions are influenced by their observations and experiences. Within this framework the research focused on pre-existing

attributes, perceived barriers and self-confidence, and the awareness of existing support mechanisms for learners.

The aim of the research was to explore the expectations and self-efficacy of first year engineering students with a view to determining if there is a mismatch with the expectations of lecturing staff. These aims were addressed through several research questions relating to the expectations of first year engineering students at third level, namely: Are students prepared for eAssessment of mathematics in the first year of study at third level? Do students perceive barriers that may form impediments to eAssessment of mathematics in the first year of study at third level? Does the self-efficacy of the students affect the perceptions of students with respect to eAssessment of mathematics?

Methodology

The research reported in this paper is part of a joint study that was developed to examine (within the boundaries of first year engineering mathematics) if the anecdotal observations were accurate. The curricula of the participating higher education institutions were analysed to determine levels of similarity in first year engineering mathematics prior to the research. Levels of similarity in programme content, assessment methods and student cohort were considered to be sufficiently close allowing comparisons to be made.

Learner Groups

First year BEng Engineering ordinary degree or equivalent learners from Ireland (n=67) and Finland (n=60) participated in the study at the beginning of the first semester. The setting was in the natural class environment to maintain a structured, non a-priori, contextual setting leading to a case study with phenomenological output to establish a baseline of the status of online assessment of first year learners in engineering mathematics. A mixed methods approach was taken to determine indicative outputs with qualitative and quantitative approaches operating simultaneously. All participants completed a questionnaire containing open and closed questions within a short timescale to ensure synchronic reliability. The questionnaire was tested to ensure issues of language were not problematic between the two countries.

Sampling for Focus Group activity was non-self selecting and based on convenience as determined by the availability of learners to the researcher. Focus Group (n = 8) activity utilised a semi-structured, standardised open question approach timed to occur shortly after questionnaire operationalization and immediately after the first online assessment exercise. All topics and issues to be covered were specified in advance; all interviewees were asked the same basic questions to ensure comparability of responses.

A second questionnaire following the same format as the first questionnaire was completed (n = 56) at the beginning of semester 2 by students in Ireland to ascertain if there was any discernable difference in the perceptions held by the students.

A group interview of self-selecting second year engineering students (n = 8) was held at the beginning of the third semester. This activity utilized a semi-structured, standardised open approach. The topics and issues to be covered were based on the salient findings from the first questionnaire; all interviewees were asked the same questions to ensure compatibility of responses.

Lecturer Group

The study involved mathematics lecturers from Ireland (n=3) and Finland (n = 2) all of whom actively engage in online assessment of mathematics. Interviews with mathematics lecturers in Ireland (n = 2) not engaged in online assessment were also conducted. Each lecturer engaged with consent in a semi-structured video interview and was asked the same questions to allow comparisons to be made. The questions were formed around the following thematic areas:

Training/Preparation for online assessment, Perceptions of student confidence for online assessment, Perceptions/knowledge of barriers for optimal online assessment.

A coding schema was developed from the questionnaire, focus group and interviews. The unit analysis selected for open question responses was complete response/phrase rather than individual words, and in order to reduce the complexity only major thematic responses would be included.

Prior to commencement of the project all institutions involved engaged in a process of extensive ethical scrutiny.

Results and Discussion

The learners engaged in this study are not considered to be from higher academic tracks. The learner group from Ireland resides in the top 67% of the student base when ability is based on Central Applications Office points. Approximately 15% of the Irish learner group entered third level from a non-CAO route such as mature access. A similar pattern describes the learner group from Finland. The researchers are cognizant that the process is subjective and the focus of the research is to establish a baseline from which to develop meaningful assessment processes.

Preliminary analysis of questionnaires (n=183) reveals that many learners struggle to engage online with abstract mathematical concepts and consider a loss of reward to be a negative attribute of the assessment process.

"I find that computer based tests aren't as effective as written tests because the test does not show fully what they are looking for"

The major thematic outputs are in the areas of self-efficacy relating to self-esteem, confidence and self, for example 37% indicated negative experiences of eAssessment.

"I find that I am unconfident and unsure about the submission of my answers"

Evidence of the digital divide was provided in the form of *"Lack of computer knowledge, Internet and access to computer itself"* and *"I don't have Internet access at home - no signal"*

Higher-level STEM cognitive assessments include calculations, determination of expressions or equations. It is suggested that the current mechanics of assessment are inadequate to fully address the needs of the educator in their endeavour to provide prompt, accurate, objective feedback. Deep knowledge based questioning is problematic to assess automatically and research has been conducted to explore this area (Ashton et al, 2006; Sangwin et al, 2013).

The eAssessment of learners exists in many programmes of study, offering a myriad of mechanisms for exploring learning at an individual and group level. We conclude that the justice executed by eAssessment of the learner needs to be enhanced further in order to provide teachers with a more sophisticated profile of the learner. The outcomes of this research will guide a second stage in the application of eAssessment in both institutions, in order to develop this sophistication.

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