Online Resource Platform for Mathematics Education

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Introduction

The aim of this project was to develop and explore the use of a Shareable Content Object Reference Model (SCORM) integrating a web-based platform for the study of mathematics as part of an active learning environment. The platform was designed to provide active support to engineering students especially those in their first year of study. Early use of the platform can identify areas of weakness and provide the self-learning environment required for students to become more proficient in areas where they are lacking key skills or are finding concepts difficult to understand.

The platform consists of a set of tools and applications for the study of engineering mathematics. The tests can adapt and change depending on the answers provided by the student, including video feedback for incorrect answers before the student progresses to the next question. Based on the idea that teaching a concept is the best way to learn that concept, the students become actively involved in the platform as they create the videos that provide feedback to the other users of the platform.

DIT Teaching Fellowships 2013-14

Methodology

The approach taken for this project follows the design-based approach described by Reeves (Reeves et al. 2004) and is illustrated in Figure 1.

- **Stage 1:** Core mathematical concepts which are proving difficult to understand are initially identified using either a standard Math’s Diagnostic Test (MDT) or through a student survey.
- **Stage 2A:** A set of online resources consisting of quizzes created by the lecturer and feedback videos created by the student are developed. The feedback videos allow students to synthesise and disseminate knowledge from various sources.
- **Stage 2B:** Evaluation of students’ performance is carried out using the online quizzes. Students are encouraged to give feedback and demonstrate active performance.
- **Stage 4:** Outcomes in the form of knowledge (i.e. student learning) and products (i.e. quizzes and videos). Feedback is obtained from students through surveys and focus groups.

Implementation

**Phase 1:** Student as co-creator

- Solutions to mathematical problems are recorded as videos.
- Consequently students determine their own learning by exploring rather than receiving knowledge.

**Phase 2:** Creating the online resource platform

- Online resources (i.e. quizzes) are created with student content (i.e. feedback videos).

Evaluation of students performance is carried out using a Shareable Content Object Reference Model (SCORM) integrating a web-based platform available to DIT students across multiple programmes and stages.

Benefits of Intervention

**Benefits of Intervention (Phase 1):**

- The students can competencies improve i.e. by discussing solutions with their peers they are encouraged to think more deeply about the problem.
- They’re better equipped to succeed in their studies as a result of developing a more robust set of core mathematical skills.
- Creating the videos is typically an iterative process which serves to reinforce knowledge of the material with each iteration.
- Students are more empowered by their participation: self-determined and learner-centred learning.
- Collective and individual responsibility.
- Greater confidence and increased motivation.

**Benefits of Intervention (Phase 2):**

- Web-based platform available to DIT students across multiple programmes and stages.
- Encourages self-learning.
- Completed at students own pace.
- Available 24/7 from any web-enabled device.

Selected Results

The initial mathematical capabilities of students from a level 7 common engineering programme were measured using a standard MDT.

The results (Figure 8) show a greater proportion of grades in the range suggesting a poor grasp of key mathematical concepts.

A sample of students responses from a survey (n = 21) are illustrated above (Figure 9). Responses are based on a 5-point Likert scale.

Additional responses (Figure 10) show a general preference for a mix of traditional and video tutorial sessions.

Rationale for Project

**European Context:**

European Higher Education Area (EHEA) Encourages the development of new competencies and skills through active learning methodologies.


**Vich Context:**

- National Strategy for Higher Education to 2030 (DES 2011):
  - Emphasised the need for teachers in higher education to… ‘stimulate active, not passive learning’
  - ‘...points to the need to... create a process of active learning by posing problems, challenging student answers, and encouraging students to apply the information and concepts’

**DIT Context:**

- College of Engineering and Built Environment (DIT 2011):
  - Response to DIT Strategy on Student Engagement.
  - Use modern technology to support student learning.
  - Increase diversity of learning experience.

Background

- Traditional hierarchical approach to learning is no longer suitable to meet the changing needs and expectations of the student.
- Communication methods are influenced by advances in technology.
  - Students: Have different learning and communication styles.
  - Instructor: Must communicate with a similar set of tools.

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Summary & Future Work

- The platform can be prolonged over time:
  - Self-improving.
  - Self-regenerating.
  - Shared across programmes and stages.
- Multidisciplinary opportunities to extend the project into other technical based modules.
- Expertise gained to be used to create interventions and support in areas where a lecturer may identify specific issues.

References


Dissemination Outputs


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