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# Technology enhanced Resources for Mathematics Education (TeRMEd)

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## Introduction

The aims of this project are to design and develop formative assessment resources for first year undergraduate mathematics modules and to evaluate the impact of these resources. The types of resources that have been developed to date include: targeted Khan Academy playlists and mastery challenges, a smart phone based audience response system that allows mathematical input, Moodle lessons, student generated screencasts and interactive tasks using Geogebra. The mathematical topics which are the focus of these resources were chosen based on the results of surveys of staff and students (Ní Shé, Mac an Bhaird, Ní Fhloinn, & O'Shea, 2016). In this poster we will present a snapshot of the resources, the evaluation methods and initial results. Augmented reality software and/or QR Codes are used in the poster to demonstrate the resources.

## Theoretical framework

The National Research Council (National Research Council, 2001, p. 116) defined mathematical proficiency as comprising of five interwoven and interdependent strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. This description of mathematical proficiency guided our design of resources. We used the Black and Wiliam (Black & Wiliam, 1998, pp. 7–8) definition of formative assessment: 'encompassing all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged' to advise our implementation of formative assessment techniques. We used technology to design and deliver the formative assessment in this project. This is not a new idea; according to the JISC report (JISC, 2010, p. 9) the benefits of using technology in assessment include allowing a greater range of types of assessments, a greater flexibility on timing and location of assessment; improved student engagement especially with interactive tasks which incorporate instant feedback, timely evidence on the effectiveness of course design and delivery.

## Methodology

The resources were developed by researchers affiliated to five different higher education institutes in Ireland who lecture on first year undergraduate mathematics. The resources were trialed in the 2015/2016 academic year. According to McKnight et al. (Mc Knight, Magid, Murphy, & McKnight,

2000, p. 10) mathematics education research is 'inquiry by carefully developed research methods' that provides evidence of the nature of teaching and learning. For the evaluation we chose to conduct student surveys, resources usage, student grades and think aloud interviews. The questionnaires, developed from similar questionnaires (MacGeorge et al., 2008; Zaharias & Poylymenakou, 2009) contained 4 dimensions; confidence when learning mathematics; impact on engagement, impact on learning and usability of the resource.

## Results, analysis and conclusions

Students were generally positive about the use of the resources, though there were differences between students' opinions on the different resources. For example students using the audience response system found that the resource encouraged them to engage more in class (over 80%) whereas only 32% of students using the interactive tasks reported accessing the extra resources when not assigned on homeworks. Based on the results of this analysis the resources are currently being modified for use in the next academic year, 2016/2017. The data from the evaluations will be further analysed to answer the research questions that we have: What are the benefits of using technology in formative assessment design? How effective are the resources in developing mathematical proficiency?

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