Using digital technology in mathematics teaching within English vocational education

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Digital technology has been viewed as a cultural revolution with the potential to transform education but its place in English post-16 education has been less prominent than anticipated. This paper explores the uses of digital technology to support the teaching of low-attaining students in post-16 vocational education by examining findings from the Mathematics in Further Education Colleges (MiFEC) project. These findings are drawn from case studies of over 30 colleges and are analysed for this section of the research in relation to three identified linked strands in the use of technology (Fullan and Donnelly, 2013). Both benefits and challenges of using digital technology in this context are identified. The pace of local system change and distinctive characteristics of the student cohort affect practice but under-developed pedagogies are also evidenced. This analysis will provide a foundation for discussion about similar or contrasting challenges in other educational contexts and countries.

Introduction

Digital technology has been viewed as a cultural revolution with the potential to transform education (Vander Ark, 2011). Although digital technology is ubiquitous in the lives of young adult students, its place in education has been less prominent than anticipated in England (Fullan and Donnelly, 2013). Evidence of positive benefits has been unclear due to the wide variety of technologies and contexts (Higgins et al., 2012) and there is limited evidence of the impact of specific technologies on learning, such as tablets (Hassler, Major and Hennessey, 2015). One reason suggested for the lack of progress is the unequal development of three essential linked strands, which Fullan and Donnelly (2013) identify as 1) the technology itself, 2) appropriate pedagogies and 3) the necessary system change.

In this paper, the uses of digital technology by teachers in post-16 vocational education are explored, drawing on findings from the Mathematics in Further Education Colleges (MiFEC) project. The paper focuses on how technology is used to support the teaching of low-attaining students, who are required to continue studying mathematics until they reach a certain minimum standard, and aims to identify both the benefits and challenges of using digital technology in this educational context.

Method

The MiFEC project consists of four interlinked strands of research about mathematics policy and practice. For the purposes of this discussion, only the relevant findings from the case study strand of the project are presented. These case studies involve over 30 Further Education (FE) colleges. FE colleges are the main providers of vocational education in England and the colleges selected for the research form a balanced sample across the nine regions of the country. Individual interviews with teachers and managers and focus groups with students took place in each college and transcripts were analysed using open coding to identify emerging themes. Further examination of the teaching and learning theme was carried out using secondary coding, leading to a consideration of how the three linked strands identified by Fullan and Donnelly (2013) are evidenced in mathematics teaching within this sample of FE colleges.

Findings

Our analysis shows that the use of technology in mathematics teaching includes a range of programmes and apps but their use is constrained by limited access to hardware and the unreliability of systems to support learning in some colleges. Overall, the use of technology in lessons is small compared to other teaching approaches, but colleges do use technology widely for initial assessment, tracking student progress and providing resources for independent student work or extra support outside class. Not all these strategies are however having the desired effect on students' learning of mathematics.

The technology used in the classroom mainly involves tools such as the students' mobile phones or computer suites within college. Some teachers report challenges with allowing students to use mobile phones since mathematics learning activity quickly strays towards unconnected use of social media. Mathematics is rarely timetabled in computer suites on a regular basis and, although these are available in college, they are not always easily accessed through college timetabling systems. In some college buildings teachers also report slow Internet connections. These limitations of college systems illustrate the constraints when local system change is not keeping pace with the educational potential that the technology affords.

Most colleges also have extensive resources available to students on a range of platforms for further independent learning and extra support. These resources are sometimes used in lessons but more commonly they are made available for independent work outside the classroom. Three issues that indicate the limitations of this approach emerge from the study. First, many of these students have little motivation to study mathematics and therefore do not engage with any learning of mathematics outside the classroom, with or without these resources. Secondly, teachers report that many of these young adults still lack the maturity and skills to study independently, so self-directed learning is not always effective. Thirdly, some students voiced strong opinions about their dislike of the programmes available electronically and stated their preference for face-to-face explanations from their teacher. The use of technology in

teaching and learning is therefore rendered less effective than intended, due to assumptions about how students' will interact with the technology inside and outside the classroom.

The most widespread use of technology evidenced in the study was the use of electronic systems, by which teachers assess and track student progress. These are clearly an essential aid, by which teachers identify students who need extra support. This often leads to targeted interventions to support students, although in some cases it also generates a volume of data that teachers cannot usefully process.

These examples of how technology is used in mathematics teaching and learning represent a narrow selection from the tools available that can open up new windows to understanding or mediate students' learning pathways (Hoyles and Lagrange, 2010). Although systemic issues and characteristics of the student cohort affect the impact on learning within this educational context, evidence of the under-use of technology in this study also suggests a need for professional development that equips teachers to utilise effectively the resources available.

Summary

The use of technology in education promises a revolution in teaching approaches but there is greater potential for a positive impact on learning than is currently being realised. Our analysis of the current situation in post-16 education in England, based on empirical evidence, suggests a number of constraints arising from under-developed pedagogical approaches and characteristics of the student cohort. This session will provide an opportunity to discuss these challenges in the context of other learning situations and make comparisons across countries.

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