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Mobile Learning to Support Computational Thinking in Initial Teacher Education: A Case Study

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ABSTRACT

Research on the role of mobile learning in computational thinking is limited, and even more so in its use in initial teacher education. Aligned to this there is a need to consider how to introduce and expose pre-service teachers to computational thinking constructs within the context of the subject area they will teach in their future classrooms. This paper outlines a quasi-experimental study to examine the role of mobile learning in facilitating computational thinking development amongst pre-service teachers in initial teacher education. The study enquires if there are significant differences in grades achieved in computational thinking and programming learning when mobile learning is introduced. Findings showed and reaffirmed the positive influence of the mobile applications on the development of computational thinking amongst the pre-service teachers who participated.

KEYWORDS

Computational Thinking, Mobile Learning, Teacher Education

INTRODUCTION

In his book entitled 'Schools of Tomorrow' John Dewey criticised the institute of higher learning of his day, arguing that education needed to adopt new instructional approaches based on future societal needs (Dewey, 1915). He further contented that schools should reorganize curricula, emphasize freedom and individuality therefore responding to changing employment requirements, emphasising that failure to do so would be detrimental to young people. The same premise is true a century later and in ensuring sustainable educational infrastructures for young people acquiring knowledge, skills and attitudes necessary for their futures, is teacher education (OECD, 2019). Mobile learning is defined as the process of learning mediated by portable, mobile technologies such as smartphones, tablet computers and game consoles (Schuler et al., 2012) and these mobile learning devices combined with computational thinking may be very much at the core of innovation in teacher education. Various educational applications of mobile technologies, termed 'mobile learning', or 'm-learning' are being examined and introduced in schools and in initial teacher education programmes (Burden, Kearney, Schuck, & Hall, 2019). There is also considerable advancements in coding and computational literacy with research demonstrating there is a need for teachers to be prepared to integrate CT into their classroom practices (Prieto-rodriguez & Berretta, 2014).

Like all technological innovations there is considerable interest in exploiting the huge appeal and availability of mobile devices and technologies for their pedagogical uses for the learner, and also

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the necessity to further integrate it in teacher education. For example, as part of the implementation of the Irish government's Digital Strategy for Schools (DES, 2015) a sub-committee of relevant stakeholders and representatives of teacher education was convened by the Implementation Group of the Minister's Advisory Board to further advance the integration of digital technologies in teacher education. The guiding framework proposed for Irish teacher educators in relation to the use of digital technologies in initial teacher education, adopts the PEAT framework of teachers' digital competence by McGarr & McDonagh (2019) and is offered to highlight the range of areas of knowledge and skills required by pre-service teachers to develop professional digital competencies (McGarr & McDonagh, 2019). To support such an approach, it is envisaged that initial teacher education (ITE) programmes should have digital technologies embedded across the initial teacher education experience (Foulger, Graziano, Schmidt-Crawford, & Slykhuis, 2017), supported by teacher educators that are competent in embedding the use of digital technologies in their own practice and suggested areas in relation to this include strategies by Fougler et al (2017). This aligns to the findings from the 2016 National Education Technology Plan by the US Department of Education whereby the categorically argue that it inaccurate to assume that because pre-service teachers are tech savvy in their personal lives they will understand how to use technology effectively in their practice. "This expertise does not come through the completion of one educational technology course separate from other methods courses but through the inclusion of experiences with educational technology in all courses modeled by the faculty in teacher preparation programs" (Thomas, 2016).

Mobile learning and computational thinking are plausible approaches for such strategies and in this paper we introduce a quasi-experimental study to gain an understanding of how mobile learning technologies may support pre-service teachers. The paper introduces the contemporary use of mobile learning technologies in examining computational thinking in teacher education, specifically in regard to computational thinking and programming competencies amongst the pre-service teachers. The results presented demonstrate the computational fluency development in the cohort examined and though not a panacea, may influence teacher education programme design.

LITERATURE REVIEW

Mobile Learning in Teacher Education

Mobile devices serve as a technology that is ubiquitous in nature, portable, and equipped with multimedia capabilities contributing to the learning content delivery to students. For the purpose of this study, mobile devices are portable handheld devices providing a touchscreen interface with computing, information storage and retrieval functionalities, combined with multimedia and communication capabilities, therefore smart phones as well as tablet devices. Smartphones and tablets permit learners to integrate computational, productivity, simulation, exploration and information retrieval tools in a central hub (Handal, Macnish, & Petocz, 2013). Furthermore these devices enable learners and instructors to immerse themselves dynamically in teaching and learning tasks 'anywhere, anytime' with research suggesting that using mobile technologies in the classroom can improve student learning (Campbell, 2013). Moreover, mobile phones used in the classroom can create a more positive learning environment (Chen, 2011).

Research has found that mobile technologies have the potential to enhance mobility in schools, consequently and fundamentally changing the way classrooms are organized across the education continuum including within teacher education programs (Handal et al., 2013; Kearney, Schuck, Burden, & Aubusson, 2012) and when these agents of change are embedded within and across teacher education programmes they are most effective (Mac Mahon, Grádaigh & Ghuidhir, 2016; 2018).

Kearney and Maher further emphasize the importance of putting pedagogy at the centre of mobile learning rather than technology in order to examine its advantages for supporting learning (Kearney & Maher, 2013). In assisting teacher educators understand mobile technology integration