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Usage of a mobile social learning platform with virtual badges in a primary school

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ABSTRACT

This study presents and examines SamEx, a mobile learning system used by 305 students in formal and informal learning in a primary school in Singapore. Students use SamEx *in situ* to capture media such as pictures, video clips and audio recordings, comment on them, and share them with their peers. In this paper we report on the experiences of students in using the application throughout a one-year period with a focus on self-directedness, quality of contributions, and answers to contextual question prompts. We examine how the usage of tools such as SamEx predicts students' science examination results, discuss the role of badges as an extrinsic motivational tool, and explore how individual and collaborative learning emerge. Our research shows that the quantity and quality of contributions provided by the students in SamEx predict the end-year assessment score. With respect to specific system features, contextual answers given by the students and the overall likes received by students are also correlated with the end-year assessment score.

1. Introduction

Mobile learning technologies present an innovation force ready to support on-demand, in-situ and real time learning scenarios. They are already being utilized in a number of initiatives around the globe (Chen, 2013; Hargis, Cavanaugh, Kamali, & Soto, 2013). The ubiquitous nature of such technologies is "personally relevant in terms of topics of interest and capitalizes on learners' location as learners decide what, where, when and whether to learn" (Jones, Scanlon, & Clough, 2013; Munoz-Organero, Munoz-Merino, & Kloos, 2012).

Since digital mobile learning technologies can be used anytime and anywhere, they need to be integrated into learning systems in an unobtrusive manner, engaging and stimulating students on repeated use. This is best reflected in recent studies on seamless mobile learning (Looi et al., 2010; Ngaka, Openjuru, & Mazur, 2012; Russell, Knutson, & Crowley, 2012), where the continuity of the learning experiences across different contexts and one device or more per student ("one-to-one") is advocated (Norris & Soloway, 2004). Seamless mobile learning harnesses the portability and versatility of mobile devices to promote a pedagogical shift from didactic teacher-centered to participatory student-centered learning. Learners learn whenever they are curious and seamlessly switch between formal and informal contexts and between individual and social learning, extending the social spaces in which they interact with each other. Seamless learning is supported by theories of social learning, situated learning, knowledge-building, and should influence the nature, the process and the outcomes of learning.

By viewing technology as a nexus between informal and formal learning environments, we are interested in leveraging motivational aspects that could potentially be a driving force for more sustained learning. We would like to see our students spontaneously engage in informal learning which is either self-initiated or emerges indirectly inspired by the school-based activities. Towards this, we designed and built a system called SamEx to support spontaneous or location-activated creation, sharing and discussion of artifacts. SamEx was put to trial use with a cohort of 305 primary school students over a period of an academic year to support and complement the learning of science. In

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this paper, we discuss the design of SamEx and the analysis of data arising from the student use, and explore the relationships of a number of variables of interest with the summative end-year assessment scores of the students.

2. Theoretical background

2.1. Self-directed learning

Nowadays schools feel a growing need to prepare their students for jobs that do not yet exist. This means teachers have to attend to the difficult tasks of developing meta-level learning and cognitive skills in their learners, in addition to covering the curriculum. One of the key traits of so called 21st century learners is self-directed learning, where students manage the learning process on their own, all from setting their own learning goals to the final evaluation of their own learning (Loyens, Magda, & Rikers, 2008). Self-directed learning is a desirable skill leading to more learning and more time spent on learning (Abar & Loken, 2010) and educators should leverage student motivation, behavioral engagement in the activity and parental autonomy support (Sha, Looi, Chen, Seow, & Wong, 2012) to achieve it.

There is some consensus that self-directed learning can be driven by a certain amount of scaffolding which is either provided by the teacher or supported by technology. Studies show that open-ended platforms such as blogging web sites or assessment-driven e-learning systems (Robertson, 2011) help learners in managing their self-directed learning. Self-regulatory behavior could be a key element of successful e-learning (Wang, 2011).

2.2. Collaborative learning

The theoretical foundation of collaborative learning draws its roots from the developmental psychology of Piaget and Vygotsky's sociocultural theory (Dillenbourg, 1999). Piaget proposed the idea of cognitive conflict where a child experiences dissonance which is the difference between what the child knows of the world and the new experiences or information. According to socio-constructivist approaches, interaction with the peers can help to facilitate such conflicts leading to the construction of new knowledge. Johnson's Social Interdependence Theory (Johnson, 2003) identifies five elements of cooperative learning: 1) Positive Interdependence; 2) Individual Accountability; 3) Promotive Interaction; 4) Social Skills; and 5) Group Processing.

Webb recommends that educators provide explicit instruction for developing collaborative skills, training the students in interpersonal and teamwork skills such as communication, coordination, problem solving, conflict resolution, and negotiation (Webb, 1995). Student can learn how to explain, give constructive feedback, ask for help and give help to their peers. Dillenbourg suggests embedding roles within tasks and these roles can have complementary knowledge or conflicting viewpoints (Dillenbourg, Baker, Blaye, & O'Malley, 1995).

2.3. Badges for learning

In addition to formal course credit systems which include standard examinations, there is a growing need for alternate ways of motivating both curricular, extracurricular activities and lifelong learning (Young, 2012). This is especially so in online courses and technology-enhanced learning tools which are used in and out of schools, where teachers need to ensure that students' additional efforts are acknowledged and appreciated. In the computer gaming world, badges are earned to indicate the achievement of certain level of skills, acquisition of knowledge, or participation in an activity.

As one implementation option, badges indicate the achieved competence level as defined by the issuer. For example, the integration of badges into existing software is supported by the Mozilla Open Badge Infrastructure (Mozilla, 2013). In the social media context, they have five social psychological functions: goal setting, instruction, reputation, status/affirmation, and group identification (Antin & Churchill, 2011). Thus, they, as epitomized in websites like Huffington Post and TripAdvisor which reward community effort content moderation via digital badges, have proven useful in applications which traditionally lack credit systems.

Badges are nowadays integrated into numerous educational learning tools (Moore, 2013; Sharples et al., 2013), including Khan Academy, BuzzMath and CodeAcademy. However, there are still doubts on whether and how badge scores contribute to the overall student grade in online learning environments (Hakulinen, Auvinen, & Korhonen, 2013). One study shows that ability and motivation of learners have to be considered when choosing the right kind of badges to be used and the kinds of effect they could have on critical learner motivations (Abramovich, Schunn, & Higashi, 2013). TRAKLA2 confirms that and states more research is needed in balancing the badge achievement criteria so that they maximize beneficial learning practices while minimizing harmful side effects; and to understand why the same set of badges had different effects on different populations (Hakulinen et al., 2013).

In a recent study on gamification and social networking in an undergraduate e-learning system which includes badges, the social networking group of students that actively participated obtained the best results (De-Marcos, Domínguez, Saenz-De-Navarrete, & Pagés, 2014). According to the authors, this suggests that traditional e-learning tools coupled with appropriate methods also foster participation. Students of the gamified group obtained lower participation scores, suggesting that this approach may emphasize competition over collaboration and sharing, thus reducing participation of students. Following this line of thought, another study of gamification (Hanus & Fox, 2014) with badges in a university setting reports on the use of combination of leaderboards, badges, and competition mechanics which did not do not improve educational outcomes and that could also harm motivation, satisfaction, and empowerment. According to the authors, decreasing intrinsic motivation can affect students' assessment scores.

On the other side of the spectrum, another recent study brings promising results and addresses the concerns regarding the negative consequences for motivation. Filsecker and Hickey report on benefits of an educational game for fifth-graders which includes badges: the use of external rewards in the context of such technology-enhanced environments does have a positive effect on learning. Their proposed mechanism for the effect of external rewards focused on the role of students' deeper disciplinary engagement (Filsecker & Hickey, 2014).

Thus, there is no consensus on in which subject areas and how are badges to be used in education. Empirical studies are very rare and the majority of papers is primarily exploratory and proof-of-concept, and do not present rounded mature research studies. What is more, badges