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Cooperation begins: Encouraging critical thinking skills through cooperative reciprocity using a mobile learning game



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ABSTRACT

Mobile learning has the advantage of being able to be used within and between contexts and can also be seamlessly integrated into broader learning experiences that include other forms of learning. Such experiences can assist in the development of cognitive and collaborative skills by encouraging learners to work together to solve problems, see others' perspectives and cooperatively find creative and critical solutions. This paper describes a serious mobile learning game designed to allow participants to play the role of business consultants to an organisation facing some serious challenges. It uses mixed reality resources to lead the players through a realistic scenario, providing them with physical, cognitive and collaborative challenges. Following mobile learning, the learners demonstrate their critical insights into the learning content by creating a consulting presentation in the classroom. Our study contrasts group cooperation where each learner is given asymmetric learning contents, with a cooperative group with two single learners given symmetric (identical) learning contents. We present the results of an experiment designed to measure the effectiveness of asymmetric learning content in fostering cooperative critical thinking, as examined by content and conversation analysis whilst preparing the consulting presentation. We found that the implicit cooperation condition – cooperative reciprocity, triggered by the asymmetric learning contents – was important for maximising critical thinking skills.

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“Competition has been shown to be useful up to a certain point and no further, but cooperation, which is the thing we must strive for today, begins where competition leaves off.” — Franklin D. Roosevelt

“Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.” (Hardin, 1968)

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1. Introduction

Hardin's *'Tragedy of the Commons'* (1968), although dealing with the depletion of natural resources rather than the gaining of knowledge, captures the difficulty of human cooperation and the power of self-interest over collective interest. We know that cooperation is hard, sometimes it is arguably an impossibility (Greene, 2014), yet without it we are left only with competition. Cooperation can be fostered, but only if self-interest and collective interest are well aligned. In this article, we endeavour to show that learning motivation can involve more than self-interest by aligning cooperation with simultaneous benefit (i.e., *cooperative reciprocity* – Trivers, 1971). We report on a learning activity using a mobile mixed-reality serious game, in which collective interest was deliberately engaged in one of the learning conditions. We also examine to what extent the collective interest shared by the learners made them more creative and critical in constructing their knowledge.

1.1. Critical thinking skills from cooperative learning: a mobile learning approach

In Dickens' *'Hard Times'* (1854), the Member of Parliament for Coketown, Thomas Gradgrind, insists that facts are the fundamental and essential building blocks of every educational activity. In the 21st century, facts alone do not have any advantages when they can be easily looked up on the Web. Thus contemporary education is not so much about factual information, but what we can do with it. This also has implications for the nature of remembering; remembering factual knowledge is less important in an information rich environment, but other forms (e.g., *meta-cognitive knowledge*, critical thinking skills, creative and innovative ideas) become more important. Therefore, we have to try to help students develop a capacity and appetite for learning and divergent thinking that will stand them in good stead their whole lives. The *Partnership for 21st Century Skills* (2011) suggests the 4Cs (critical thinking, communication, collaboration, creativity) as the contemporary core skills.

There is little question that the nature of education must change to meet the challenges of the 21st century, now that knowledge production and dissemination is a distributed and interactive activity, mediated by Information and Communication Technologies, entailing a shift from knowledge production to knowledge configuration (Gibbons, 1998). Whilst a greater level of inclusion in education, particularly higher education, has been seen in many countries, simply producing more graduates is not itself a solution to the problem of educating for a changing world (Chang, 2010). Rather, there is a widely perceived need to provide an education that is somewhat more pertinent to the needs of both individuals and society.

Much has been written about what types of skills a 21st century learner needs to develop. In general, the core skills are taken from the higher levels of Bloom's taxonomy; *analysis*, *synthesis* and *evaluation* in the original taxonomy; *analyse*, *evaluate* and *create* in the revised taxonomy (Krathwohl, 2002), increasingly supplemented by newly required skills such as the ability to filter out meaning from the mass of information only recently made available to us (Dede, 2007). Often these skills are summarised as aspects of critical thinking. Willingham (2008) referred to critical thinking as "seeing both sides of an issue, being open to new evidence that confirms your ideas, reasoning dispassionately, deducing and inferring conclusions from available facts and solving problems".

A number of methods have been suggested to assist the development of critical thinking. Cooperative learning, where two or more people learn something together, is one such example (Dillenbourg, 1999). Abrami, Bernard, Borokhovski, Wade, Surkes, Tamim, et al. (2008) note in their review of the literature that collaboration has a positive effect on critical thinking skills (though other factors in the learning context are also important). We might contrast this with the view that self-interest (or at least lack of interest in cooperation) kills creativity (Bechtoldt, Dreu, Nijstad, & Choi, 2010). Gokhale (1995) suggested that cooperative learning could enhance the development of critical thinking through an alternating 'speaker-listener' process of *evaluating*, *discussing* and *clarifying a partner's thinking*. A further question is the extent to which cooperative learning is encouraged by mutual benefit (i.e., *reciprocity* – Salomon & Perkins, 1998; Donahue, Bowyer, & Rosenberg, 2003). We are more likely to offer help when we feel that others might help us. In contrast, uncooperative behaviour triggered by self-interest will lose the potential benefits of future cooperation. Palmer and Steadman (1997), Brosnan, Freeman, and De Waal (2006), Simon (1990) and others also claimed that mechanisms of cooperative reciprocity can account for various types of cooperation that spread through many different cultural settings. In this article, therefore, we question whether an expectation of another learner's cooperation might encourage one's own cooperative learning behaviour, and in turn whether such acts would foster more critical thinking skills.

A primary research theme addressed in this article is how we might leverage a mobile learning activity to trigger such cooperative learning. Using a mobile serious mixed-reality learning game, designed to allow two learners to play together the role of business consultants to an organisation, we describe the cooperative reciprocity provided in the learning activity, and explore the impact of this on critical thinking.

1.2. Cooperation begins with mobile mixed-reality learning

Game-based learning has become an increasing focus for educational researchers (Prensky, 2005; Dondlinger, 2007). Its focus on both learning content and motivation (through gamification concepts such as rewards and rankings) is seen as effective (Prensky, 2005). Further, situated and contextual game-based problem-solving in a physical environment can present direct learning experiences (Tan & Soh, 2010). The assumption is that the pairing of instructional content with certain

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