Scoping Study: Report

Overview

This report summarises findings from a scoping study completed as the first phase of the Erasmus+ KA2 research project: Designing and Evaluating Innovative Mobile Pedagogies (DEIMP). This scoping study will inform the design and development of a multi-purpose mobile app that will support educators and pre-service teachers in designing and evaluating creative and innovative learning episodes for their students. The scoping study comprised two parts: a *Systematic Literature Review* (SLR) and the *Delphi study*. The report will discuss both of these components, but starts with a discussion of innovation as this is relevant to the SLR and Delphi study.

Background on 'Innovation'

The word 'innovation' is used liberally across education literature, policies and reports (Moyle, 2010) to describe new ideas, products, approaches or processes (Fenwick, 2016). Innovations can be small or large-scale but need to go beyond superficial change to introduce new ideas or practices that are impactful and valuable to individuals or communities (Denning, 2004; Fenwick, 2016; Linfors & Hilmola, 2016). In an education context, for example, innovation could mean new curriculum, pedagogy or assessment solutions to improve student outcomes (Danaher, Gururajan & Hafeez-Baig, 2009).

Interpretations of 'innovation', or the extent to which an idea or process is new or impactful will ultimately depend on one's perception and context (Caldwell, 2018). Tornatzky and Fleischer (1990) suggest that innovation needs to be impactful at least to the people or organisation carrying out the innovation.

There are two ends of the innovation 'spectrum'. At the more conservative end are 'sustaining innovations', described as an adaption of existing approaches (Christensen, Horn & Johnson, 2008; Fenwick, 2016) and a trade-off with established practices and paradigms (Christensen, 1997). Alternatively, at the radical end of the spectrum, 'disruptive' innovation is extremely different to the status quo and can initiate a paradigm shift (Christensen, 1997), transforming existing, dominant practices. In education, disruptive innovations create new practices, purposes and processes, (e.g. of learning), new relationships between students and teachers, and potentially a change in the nature of school and its relationship with the community: "…the innovation as a whole can be considered a 'disruption' to prevalent practices" (Law, 2008, p. 428). These new practices may demand reimagining of schooling.

Innovative digital pedagogical approaches, or what Law (2008) calls 'ICT-using pedagogical innovations', typically explore the use of learning technologies to support new strategies that might change or replace traditional teaching approaches. Hedberg (2006) advocates the use of innovative digital pedagogies that facilitate a shift towards constructivist pedagogical approaches adopting student-centred learning strategies. He argues that these approaches give students control over choice of learning topics and sequences and typically encompass

emphasis on their creation, evaluation and synthesis processes. They support a shift from the learner as "a passive participant toward an active engaged constructor of their own experience" (p. 181). However, Law (2008) warns that innovative digital pedagogies do not depend on the technology but rather on the intended use of the technology and the educational context. More recently, a team at The Open University in UK has issued an annual report on 'new forms of teaching, learning and assessment for an interactive world' (Ferguson et al., 2017), focusing on "novel or changing theories and practices of teaching, learning and assessment for the modern technology-enabled world" (p. 6). The group defines digital pedagogical innovation as: "new pedagogies making use of technologies to go further, to open up new possibilities" (p. 8).

Finally, in their discussion of innovative mobile digital pedagogies, Schuck, Kearney and Burden (2017) discuss 'Third Space learning' as a disruption to existing practices: "The ways that portable, multi-functional mobile devices can untether the learner from formal institutional learning give scope for learning to be conceptualised in an expanded variety of places, times and ways" (p. 121) .

Systematic Literature Review

With the above discussion in mind, we conducted a SLR to explore innovative mobile digital pedagogies in school education. An SLR comprises more than an ad hoc search of literature. Instead, it uses a set of criteria and a well-defined procedure to scan various databases for articles that fit the criteria. We initiated the SLR with a focus on the following research question:
How does the use of mobile technologies support innovative teaching and learning practices for school-aged learners?

Three major search terms were derived for the SLR: 'mobile learning', 'innovation', and 'school-aged learners'. From these major search terms, synonyms and alternative terms were identified. For example, informed by the literature on digital pedagogical innovation, the 'innovation' component of the search string included words such as 'disrupt', 'renew', 'redefine', as well as phrases such as 'new practice', 'new teaching approach' and 'emerging learning strategy'. The search string was applied on a range of databases to ensure that relevant studies were not missed.

This initial search and selection process yielded 208 papers. A further selection process was then carried out which yielded 72 papers. This process involved pairs of researchers applying the following selection criteria to all 208 papers included in the search results: the paper had been published in English between 2010 – 2017; the SCImago journal ranking (SJR) of the paper was in the top two quartiles; the study targeted school-aged learners (5-18 years); the study adopted a rigorous methodology and compelling evidence was presented; the paper

focused on innovative mobile pedagogies (as defined in the previous section) and strategies and approaches were identified (e.g. as interventions).

If these criteria were not met, the paper was excluded. Issues related to the possible exclusion of papers were resolved through inter-researcher discussion at team meetings and any remaining questions were resolved by reading the full text of papers. A chapter was written describing this process. Principles underpinning innovative mobile pedagogies were derived from this set of papers - see below for discussion of process.

We then set about a more finely grained selection process to identify the range of innovation shown in the papers. We removed papers on special education needs as innovation in this context was deemed to be different from mainstream contexts. We also removed papers that we felt, on a second reading, were not sufficiently disruptive to be included. At the conclusion of this process there were 57 papers (references available here) selected as being suitable for inclusion in this SLR.

We identified four criteria from the discussion above - task/activity; context of the learning; relationship between teacher and student; and finally, student agency. A table was set up so that each criterion could be scored from 1 (low) to 3 (high). No zero was anticipated for any criterion as the papers were all regarded as innovative to lesser or greater extents. Each team member independently scored a selection of papers and scores were statistically analysed for outliers. After discussion of the outliers, team members reviewed their original scores to seek greater consistency in understanding.

As a final step, we scrutinised the final selection of 57 papers to identify studies that investigated or described practices that contained elements of disruptive innovation, again informed by the literature on digital pedagogical innovation (see previous section). Only 22 papers were identified as containing medium to high levels of disruptive innovation practices in the context of m-learning, with the remaining 35 papers focusing on sustaining digital pedagogical innovations. Four of these nine papers were from Singaporean projects with primary/elementary school-aged learners, three focusing on science learning (Looi, Sun & Xie, 2015; Toh, So, Seow & Chen, 2017; Zhang et al., 2010), and one on language learning (Wong, Chai, Zhang & King, 2016). The remaining five papers were from projects in South Korea (Ahn & Lee, 2015), focusing on language learning of middle school students; Israel (Barak & Ziv, 2013), with a focus on middle school environmental education; The Netherlands (Schmitz, Klemke, Walhout & Specht, 2015) in the context of health education; Australia (Bower et al., 2014) focusing on secondary school visual arts; and the US (Akom, Shah, Nakai & Cruz, 2016), focusing on community learning. Of these 22 papers, only three papers (Akom et al., 2016; Barak & Ziv, 2013; and Toh et al., 2017) focused on practices that were assessed by the research team as demonstrating high levels of mobile pedagogical innovation, containing pedagogical elements that could potentially disrupt traditional practices.

Principles underlying innovative mobile pedagogies

As indicated above, our SLR identified an original set of 72 papers that discussed innovative or disruptive use of mobile pedagogies. We then identified a set of pedagogical principles that were apparent in the selected papers. The set of principles identified from the SLR originally comprised a group of 42 distinct principles. By grouping like principles together, the list was narrowed down to a group of 21 principles. See Table 1 for details of these principles and the descriptions.

Table 1: Principles underpinning innovative smart mobile pedagogies emerging from SLR

Seamless learning: Activity occurs across a variety of physical and/or virtual settings
Digital play: Activity involves explorations without an explicit curriculum goal
Student agency: Students have choice of how to do activity
Student autonomy: Students determine the activity
Gamification: Applies elements of games such as competitions, random events, scoring
Customisation: Learning pathways are adapted to individual input
Authentic environment: Activity occurs in situ (that is it occurs in its original or natural location)
Simulation: Conducting realistic virtual task e.g. Google expedition
Context-awareness: Activity adapts to environmental stimuli, for example new vocabulary is determined by external items
Data sharing: Learners share digital artefacts with peers
Artefact construction: Learners make digital object e.g. video, music, game
Co-construction: Learners use collaborative authoring tools e.g. Google docs
Reflection: Learners reflect in multimodal ways e.g. with vlogs, colours, sound
Real-world processes: Learners engage in activities similar to those done by practitioners e.g. testing aero-dynamics of object with app

Real-world tools: Activity uses app as tool e.g. to compose music or paint a picture
Role-play: Learners assemble tools and methods and enact roles e.g. citizen journalist
Peer review: Learners review each other's contributions e.g. via blogs
Co-design for mobile learning: Students and teachers 'mobilise activities' i.e. transform them into ones with mobile features
Intergenerational learning: Learners across different generations work together e.g. capturing an oral history
Bridging: Learners work across formal and informal contexts
Community-based: Learners conduct a community activity or project e.g. monitoring litter

The SLR has found that these 21 principles, or variations of these, underpin the innovative and effective activities that are discussed in the m-learning literature.

Given the lag in take-up of disruptive pedagogies by school teachers, the following recommendation is suggested: that the type of innovation we should be encouraging in education of school-aged students, incorporates change that is not merely involving small increments in innovation or what we have called sustaining innovations but ones that have some elements of disruption in them. However, we should not expect all teachers to embrace radical innovation as this expectation is likely to lead to a low take-up of innovation of any kind, given that it will be too challenging for most to adopt such disruptive practices. *Rather we suggest that we encourage innovation somewhere between conservative and radical and view disruption as being on a continuum. An important aspect of disruption in the context of school-aged learning with mobile devices, we argue, is that it is feasible.*

Our next step in the scoping study was to select a Delphi panel to provide expert opinion on the relative importance of the principles in the design of effective mobile pedagogical activities. In the next section we describe the process for selecting the Delphi panel. We then describe the process used for ranking the principles, a process also used with partner schools in the project.

Delphi Panel

The project team members were asked to nominate three to four candidates who would fit the criteria for membership of an international panel of experts. These experts were asked to participate in a Delphi panel for this second stage of the scoping study. Nominees' background and expertise were scrutinised by the team for their expertise in mobile learning,

digital pedagogies and familiarity with school-aged learning. A total of 41 experts met all criteria for selection and were invited to participate. The final selection included 13 academics, 8 teacher educators, 8 teachers, 3 advisors, 3 CPD trainers, 2 policy makers, 2 principals and 2 others.

Ranking of Principles

We then developed a ranking exercise, known as a Best-Worst Scaling (BWS) exercise. A BWS allows respondents to choose the most important factors and the least important factors in a number of opportunities that allow the factors to be played off against one another. These multiple scores allow each person to identify their most important choices relative to the other choices.

The 21 pedagogical principles presented in the previous section were embedded into a Best-Worst Scaling survey (Burke et al., 2013) for consideration by the panel and teachers in our associate partnership schools across the project (approximately thirty schools). The survey investigated the relative importance of each principle in the design of effective mobile pedagogical activities. The research question for this component of the scoping study is:

What are the principles that should underpin the design of effective mobile learning activities for 5-18 year olds?

The panel and teachers were asked to select the principles they considered to be most important relative to other principles, in designing effective mobile activities. An overview of this Best-Worst Scaling (BWS) methodology is detailed by Burke et al. (2013):

> BWS is a method that permits the quantification of how important a particular issue is to an individual or group of individuals relative to other issues under consideration. … Rather than evaluate factors in isolation, BWS experiments involve asking people to consider several factors at once and nominate which factor best matches some criterion of interest to the researcher and, from the remaining factors, nominate the single factor that least matches that criterion. People then see a different set of objects and complete the task a number of times. The researchers count the number of times an item is chosen as best and the number of times it is chosen as worst: items that are viewed more favourably by respondents on a given criterion will be chosen more often as best, and chosen less often as the worst in any one set. In essence, a BWS experiment allows respondents to simply indicate the best and worst options in a given set. (p. 260)

Preliminary results

The BWS activity is ongoing at the time of writing this report (we are aiming for a total of 100 participants, including teachers). Preliminary results are shown below for 58 participants: 36 Delphi panelists and 22 teachers from partner schools.

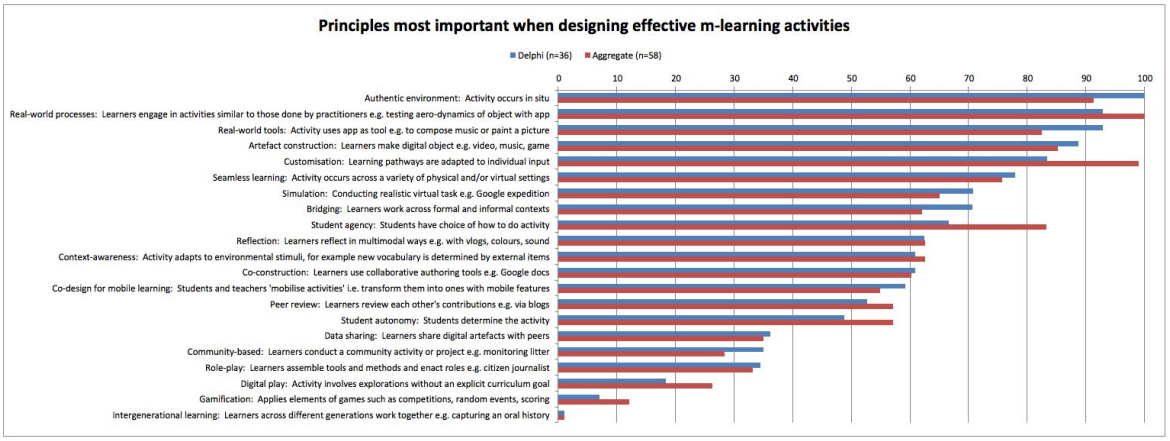

Figure 1: Twenty-one principles, as prioritised by Delphi panelists and teachers (*Preliminary results* for n=58)

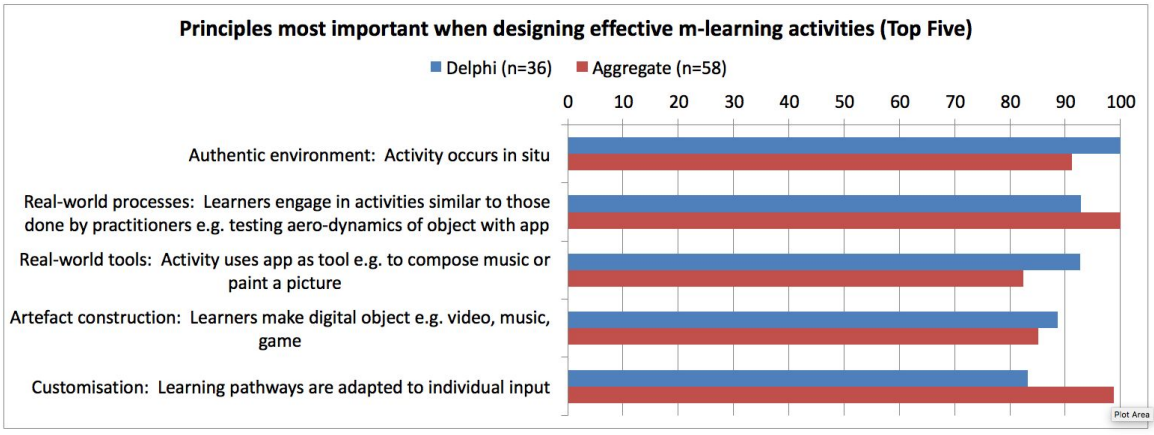

Figure 2: Top 5 principles, as prioritised by Delphi panelists and teachers (*Preliminary results* for n=58)

Next Steps

The next stage after the scoping study is the development of a set of innovative mobile learning scenarios. Exemplar scenarios were designed by the project team at the Cyprus meeting of the DEIMP project (May 2018, meeting 2). These scenarios will be completed before the 3rd DEIMP meeting (September 2018, Galway).These scenarios are informed by the principles discussed above. The exemplar scenarios are currently being designed as stimulus for the school teachers' creation of scenarios at upcoming multiplier events. An example is below:

Example of scenario (By project members: Ton Koenraad, Jeroen Bottema and Sandy Schuck)

Core principles (5 from set of 21):
Student agency; Authentic environment; Simulation; Data sharing; Reflection

Background: This is an activity to support the development of target language skills (speaking, listening, writing, reading) of secondary school students. The difficulty can be adapted to the age/language level of the

students.

Scenario
Students at a school in one country twin with other students from another country's school. Students create a location-based tour of their own environment for the visiting group. Students choose five sites and take photos of the sites, choosing sites of interest. These can be historical, sport, geographic, cultural etc. Student designers of the tour indicate in target language why the site was chosen, what was special about it and any other details of interest. A similar process occurs in the other country using the same target language. In the preparation phase, students work in groups/teams with students from each school working on a common topic e.g. sport.They share the itineraries with each other. The tour itinerary includes assignments for each site. Examples are interviewing locals at the site in target language, audio-recording their impressions of the site in target language, role playing a tour guide – showing how you would introduce the site to the tourists, giving directions on getting to the site. These assignments can have some preparation/research before students visit the other country, but they are conducted when at the actual site. Teacher is supporting students to do the task when preparing, by assessing quality of the local tour and practising pre-task activities and supporting preparation of the tasks they will do on the visit.

Once the students actually visit the other country, students do the assignments set by the host students. Students upload their task results (photos, recordings, videos) to a shared online site.

Then the team works together to assess the task results with a focus on the language. Teachers guide this process.

Alternatives
If actual travel is not feasible then students could prepare an audioguide of the tour, with explanations and details about the different sites. The tour will be conducted virtually, the assignments would be adapted, are conducted in a classroom environment, and could be shared with the students of the twin school.

Possible apps: Tripventure or izi.travel where students can create a tour, and conduct the tour when students visit.

Figure 3: Example of innovative m-learning scenario using 5 of 21 core principles (from project team members)

Following the completion of this process we will use selected scenarios for teachers to pilot and evaluate. These will then be used as exemplars in the mobile app the project team is developing as the principal output of the project.

Kevin Burden, Matthew Kearney, Sandy Schuck
University of Hull, UK; University of Technology Sydney, Australia
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