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RESEARCH ON MOBILE LEARNING ACTIVITIES APPLYING TABLETS

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ABSTRACT

The paper aims to present current research on mobile learning activities in Lithuania while implementing flagship EU-funded CCL project on application of tablet computers in education. In the paper, the quality of modern mobile learning activities based on learning personalisation, problem solving, collaboration, and flipped class methods is compared against the quality of traditional, mostly face-to-face learning activities based mainly on knowledge transmission. Research was twofold – on the one hand, the results of online questionnaire of teachers and students participated in the first cycle of CCL pilots in Lithuania were analysed, and on the other – expert evaluation method was used. A special attention is paid to suitability of learning activities to particular students learning styles. Presented approach on learning activities quality evaluation and optimisation problems could help educational institutions to select suitable mobile activities for particular learning styles.

KEYWORDS

Mobile learning, tablet computers, learning activity, personalisation, expert evaluation.

1. INTRODUCTION

The paper aims to present current research on mobile learning activities (LA) and learning scenarios (LS) applying tablet devices for secondary education in Lithuania while implementing CCL (2014) – the flagship EU-funded project in the area. Mobile learning presents new opportunities for both the design and delivery of learning. These opportunities are enabled by the unique hardware and software capabilities of mobile devices (e.g. tablets) coupled with convenient size and portability. Among all mobile devices, tablets are mostly used for learning at the moment – 61% (Kurilovas 2014).

In the paper, the quality of modern mobile LA using tablets based on learning personalisation, problem solving, Web 2.0 enhanced collaboration, content creation, and flipped class methods are compared against the quality of traditional, mostly face-to-face LA usually based mainly on knowledge transmission currently applied at comprehensive schools in Lithuania. Currently, mobile LA and LS for primary and secondary education are deeply analysed, applied, and evaluated in EU in CCL project while LA and LS are created using methodology elaborated and applied in parallel large scale EU-funded 7FP iTEC (2014) project.

The Creative Classrooms Lab (CCL) project is developing innovative teaching and learning scenarios involving the use of tablets in and out of school. It validates these in policy experimentations involving 9 Ministries of Education in Europe and 45 classes that are already making use of tablets from different suppliers. Ministries of Education also seek to co-design action research pilots with industry partners that are project Associate Partners. CCL is one of the means to help European Ministries of Education to make proper decisions concerning large scale investments in tablet devices and related teacher training.

Systematic review of scientific literature performed in ISI Web of Science database on topics ” ’information technologies’ AND ‘personalisation’ ”, and ” ’tablet devices’ AND ‘education’ ” has shown that tablets could have a positive impact on learning personalisation and thus on learning quality, but their additive value highly depends on proper application of suitable learning scenarios and learning activities (Kurilovas 2014).

2. RESEARCH METHODOLOGY

2.1 CCL Personalised Learning Activities and its Expert Evaluation

In CCL, we have prepared a typical problem solving scenario based on personalised learning approach using Web 2.0 based group work, content creation, and flipped class methods for piloting in Lithuanian CCL schools. Problem solving scenario was implemented by the following steps: (1) Discussing the problem scenario in the groups which promotes communication skills and cooperative learning; (2) Brainstorming ideas to cross the learning boundaries which promote creative learning and knowledge integration; (3) Identifying the learning issues for research which promotes active learning and critical thinking; (4) Research to construct the action plans which promotes new knowledge development; and (5) Reporting the research findings to the groups which promotes peer-to-peer learning to complete the final products.

Personalised learning approach was implemented here by division of learners into distinct groups according to their learning styles. We used learning styles grouping method applied earlier for evaluating LS quality by Kurilovas & Zilinskiene (2012), namely, Activist, Theorist, Pragmatist, and Reflector: (1) Activists learn by doing; their preferred activities are: brainstorming, problem solving, group discussion, puzzles, competitions, and role-play. (2) Reflectors learn by observing and thinking about what happened; their preferred activities are: paired discussions, self-analysis questionnaires, personality questionnaires, time out, observing activities, feedback from others, coaching, and interviews. (3) Pragmatists need to be able to see how to put the learning into practice in the real world; their preferred activities are: time to think about how to apply learning in reality, case studies, problem solving, and discussion. (4) Theorists like to understand the theory behind the actions; their preferred activities are: models, statistics, stories, quotes, background information, and applying theories.

There are different methods to determine students' learning styles, e.g. questionnaires, learners' interviews, analysis of their e-portfolios, data mining etc. In CCL, we have developed online questionnaire and software to automatically establishing students' learning styles. Its application in Lithuanian CCL schools has shown that there are almost no 'pure' Activists, Reflectors, Pragmatists or Theorists in real life – students are mostly "mixtures" of different learning styles. Lithuanian schools involved in the project have identified their students' (128 persons) learning styles as follows: mostly Activists – 27.5 %, mostly Reflectors – 13.7%, mostly Pragmatists – 29.4 %, and mostly Theorists – 29.4 %.

After that, students' learning styles were interconnected with suitable learning activities, types of LOs, tools and tablet apps. Learners were divided into distinct groups according to their learning styles before or just after Discussion stage of the problem solving activity. This could guarantee that, in their groups, learners could learn using similar suitable LAs, LOs types, and apps. Learners were divided into groups applying TeamUp grouping tool created in iTEC. Collaboration in groups was based on face-to-face collaboration and Web 2.0 tools. Groups' internal collaboration activities were applied in Brainstorming, Identifying the research issues, and Research steps, and combined with the other groups in Discussion and Reporting steps of the problem solving LA.

In CCL, we have proposed mobile personalised LA (let us call it LA_1) on problem solving in STEM (Science, Technology, Engineering and Mathematics) subjects. Mobile LA created by the Lithuanian CCL lead teacher is named "Why ships don't sink" and conforms to 10-lessons Lithuanian Physics curriculum topic on the Archimedes' law. Other teachers' mobile LA were carried out at Biology, Computer Science, Mathematics and Physics subjects lessons are named respectively "Why Materials Change in Nature?", "How to Help a Friend Choose a New PC?", "Research on Phenomena with One Variable Properties", "Why the Clothes Become Dirty?". In these mobile LA_1, students use tablets in all stages of their problem solving activity for grouping, research, collaboration, flipping, content creation, and presenting their research results to peers and teacher. In LA_1, students use personalised learning methods, suitable content and apps while working with iOS (iPads) and Android (Samsung tablets) operating systems. There were several outdoor activities implemented in these LA_1 such as visiting sea museum, homework etc. On contrary to LA_1, we consider LA_2 as traditional "one size fits all" activity based on topic explanation in classroom and students' home works.

Typical LS could consist of LOs, LAs, and learning environment(s). In this paper, we pay special attention to LA since our aim is to analyse LS independently of its learning objects and environment(s). In this research, LA_1 and LA_2 use the same learning topics of Lithuanian curriculum.

Further, we'll use LA quality criteria that were elaborated earlier while implementing iTEC project by Kurilovas & Zilinskiene (2012) and presented in Table 1 below. In the paper, Fuzzy AHP method (Chang 1996) was applied to perform expert evaluation of LA_1 and LA_2. 3 experts (the authors of the paper) have expressed their opinion on importance (i.e. weights) of LA quality criteria, and also identified the ratings (values) of LA quality criteria.

2.2 Online Questionnaire

Online questionnaire was created by the authors and filled in from 2nd to 16th of April 2014 after implementing the first cycle of CCL pilots. In Lithuania, five secondary schools participate in CCL and filled in the questionnaire. The questionnaire for Lithuanian CCL schools consisted of 5 questions concerning different aspects of the proposed CCL LS impact on learning motivation and results. The formulation was as follows: "What characteristics of mobile CCL scenarios were helpful in terms of better students' motivation and learning results?", and the following characteristics were suggested: (1) Identification of students' learning styles using proposed online tool; (2) Suitable learning activities, methods, LOs, tools and tablet apps were identified and proposed for students according to their learning styles; (3) A proper set and sequence of learning methods was used (e.g. problem solving, flipping, collaboration, content creation); and (4) The main mobile features of tablets were used (e.g. outdoor activities, shooting etc.). The last question was the open one: "Other success factors".

3. RESEARCH RESULTS

3.1 Online Questionnaire Results

Online questionnaire results were as follows: (1) Positive (40%) and preferable (more positive than negative) (60%) impact. According to comments on the 1st question, "Students were interested to know their learning styles. Learning became more productive. Knowing students learning styles, teachers could select suitable tools, apps and methods". In some classes, "it was hard for students to answer psychological questions, and, therefore, maybe their learning styles were identified not precisely". There were students with different learning styles identified, e.g., in one class, "there were two activists groups, two theorists groups, and one reflectors and one pragmatists group". (2) Positive (40%) and preferable (60%) impact: "Students were motivated, and this improved their learning results. Students could control their learning by themselves". (3) Positive (80%) and preferable (20%) impact: "Activists and theorists were happy to learn in groups. Majority of students were satisfied with flipped classroom and mind mapping". (4) Positive (60%), preferable (20%) and more negative than positive (20%) impact: "One of the lessons took place in Sea museum, and students used shooting and monitored computer simulations". In some schools, there were legal problems to bring tablets out of school due to insurance problems. In one class, BYOD (Bring Your Own Device) principle had more negative than positive impact due to interoperability problems. (5) Other mobile LA success factors. Some schools consider that "Students created content should be placed in cloud. Tablets should be new and qualitative to allow all mobile activities (shooting, using apps etc.)". Some schools wrote about "importance of schools administration support and understanding".

93 % of all students involved in LA_1 were satisfied with such learning way, and the greatest difficulties encountered faced Reflectors as they don't like to use technologies or can't choose the suitable one however only half of them indicated it as problem. The majority of students indicated that the personalisation is very important as it gives the possibility to learn with someone who thinks in the same way thus it becomes easier to understand each other. Also, the outdoor activities were indicated as a very acceptable form of learning due to the similarity of the game that gives a sense of fun and freedom.

3.2 Expert Evaluation Results

After application of fundamental scale of absolute numbers for estimation of the weights of LA quality criteria, the criteria importance table is as follows:

Table 1. Experts' opinions on importance of LA quality criteria

LA quality criteria	Expert 1	Expert 2	Expert 3
1) Ease of use	4	7	5
2) Conformance with learning goal	3	3	4
3) Interoperability and flexibility	8	8	8
4) Feedback and appropriate assessment	7	6	7
5) Active engagement of learners in learning	5	2	2
6) Facilitation of interaction and collaboration	6	5	6
7) Employment of multiple teaching methods	2	4	3
8) Incorporation of learners backgrounds, experiences and expectations	1	1	1

Based on Table 1, criteria weights obtained while evaluating importance of the quality criteria by the experts are presented in Table 2:

Table 2. Weights of LA_1 and LA_2 quality criteria

a_i	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8
Weights	0.012	0.165	0.001	0.001	0.227	0.022	0.201	0.371

According to (Kurilovas et al. 2011), in the case of using average Trapezoidal Fuzzy Numbers (TFNs), linguistic variables conversion into non-fuzzy values of the evaluation criteria should be as follows: "excellent" – 1.000, "Good" – 0.800, Fair – 0.500, "Poor" – 0.200, and "Bad" – 0.000.

The TFN ratings (values) of the analysed LA quality criteria by the experts are as follows:

Table 3. Ratings of LA_1 and LA_2 quality criteria

Learning activity	Ratings							
LA_1	0.500	1.000	1.000	1.000	1.000	1.000	1.000	1.000
LA_2	1.000	1.000	0.500	0.500	0.200	0.200	0.500	0.200

After using the TFN application method, the experts' additive utility function (Kurilovas et al. 2011) should be applied to calculate the sum of the weights multiplied by the ratings (values) of the quality criteria for each of the explored LA alternatives.

The results of experimental evaluation of the analysed LA quality using weights (Table 2) and ratings / values (Table 3) are presented in the experts' additive utility function as follows:

$$a_i \cdot f(X_j) = (0{,}9940 \quad 0{,}4025)$$

The obtained evaluation results mean that LA_1 meets 99.40% quality in comparison with the ideal, and LA_2 – only 40.25%. Therefore, LA_1 is much better alternative for students in comparison with LA_2.

LA_1 advantages are better feedback, more actively engagement of students in learning, facilitation of interaction and collaboration, employment of multiple teaching methods, and incorporation of learners' backgrounds, personal experiences and expectations. The experts believe that LA_1 has more possibilities for feedback, more actively engages students in learning, facilitates interaction and collaboration, employs multiple teaching methods, and incorporates learners' backgrounds, experiences and expectations in comparison with LA_2. LA_2, in its turn, is more easy to use in schools at the moment. On the experts' opinion, LA_1 based mobile learning using tablets could have a noticeable additive value for Activists and Pragmatists, and they could be also useful for Reflectors, but they have only minor additive value for Theorists.

4. CONCLUSION

Research results have shown that modern mobile learning activities applying tablets based on problem solving, personalisation, collaboration, and flipped class are more flexible than traditional ones, they have more possibilities for feedback, more actively engage students in learning, facilitate interaction and collaboration, employ multiple teaching methods, and incorporate learners' backgrounds, experiences and expectations. Students were motivated while applying personalised learning approach, suitable activities,

tools, LOs, apps, and proper sets of learning methods. On Lithuanian teachers' opinion, one of the main success factors in CCL was personalisation by interconnecting students' learning styles with suitable activities, tools, LOs, apps and proper sets of learning methods and thus creating personalised learning scenarios for their students.

Research results have also shown that the proposed quality evaluation approach: (1) is applicable in real life situations when educational institutions have to decide on use of particular learning activities for their education needs, and (2) could significantly improve the quality of expert evaluation of learning activities by noticeably reduce of the expert evaluation subjectivity level.

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