

Mobile Devices and Flipped Classrooms in Higher Education: An Impact Analysis on the Educational Landscape in a Turkish University

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Abstract—Mobile technologies can be used to enhance learning experiences of students in different ways, supporting the CILP, the creative and innovative learning process. In this study was analyzed how the combination of the flipped classroom approach and mobile devices used as educational tools in higher education could support innovative learning in a university in Turkey. The results of the study revealed that the flipped classroom approach created a leverage effect on the use of mobile learning elements, having a direct positive impact on the overall student achievement.

Keywords—mobile devices; learning; higher education; university; learning impact

I. INTRODUCTION

Mobile technologies can be used to enhance learning experiences in a number of different ways. Learners' data and information can be dynamically integrated over time and space, thereby creating new forms of collaborative and integrative learning for both students and educators. The challenge for educators and designers is one of understanding and exploring how these resources might be used best to support learning. With respect to technologies, 'mobile' generally means portable and personal, like a mobile phone. In some countries, the use of m-learning for students located in remote places is taken as an advantage for communication and for media content development. A variety of devices are used and m-learning solutions are offered in companies and universities. Implementing mobile services in education as mobile learning modules is an innovative process at many levels of universities. E-learning developers and course instructors must be aware of the changing user preferences, technological issues, and the new tools available in order to be able to determine how to benefit from them [1], [2], [3]. The whole world is going mobile, mobile phones, PCs and media devices nowadays fit in everyone's pocket and can connect him or her to a variety of information sources and enable communication nearly everywhere, regardless of location. There is considerable interest in exploiting the almost universal appeal and abundance of these technologies for their educational use [4].

II. NEW LEARNING PRACTICES AND MOBILE TECHNOLOGIES

Mobile learning is learning that is accomplished with the use of small, portable computing devices, it can be used to enhance the overall learning experience for students and teachers. 'Through mobile support, learners' throughput rates might be improved and the quality of the learning experience enhanced. Active learning might immerse where previously inactive studying took place'. The field of wireless technologies is developing exceedingly fast. Most of the developments contribute to the greater feasibility of mobile learning and to the richness of the courseware that can be developed for mobile learning. All of this has greatly facilitated the development of mobile learning and has contributed to the richness and complexity of courseware on mobile devices [5], [6], [7]. Below there are summarized learning approaches with associated mobile learning activities, to give an overview on challenges of integrating mobile technologies in learning environments [4].

TABLE I. LEARNING ACTIVITIES AND THEIR RELATIONSHIP TO MOBILE TECHNOLOGIES.

Learning activity	Shortcut	Description
Behaviorist	Activities that promote learning as a change in learners' observable actions	Learning is thought to be best facilitated through the reinforcement of an association between a particular stimulus and a response. Applying this to educational technology, computer-aided learning is the presentation of a problem (stimulus) followed by the contribution on the part of the learner of the solution (response). Feedback from the system then provides the reinforcement.
Constructivist	Activities in which learners actively construct new ideas or concepts based on both their previous and current knowledge	Learning is an active process in which learners construct new ideas or concepts based on both their current and past knowledge. Learners are encouraged to be active constructors of knowledge, with mobile devices now embedding them in a realistic context at the same time as offering access to supporting tools.
Situated	Activities that promote learning within an authentic context and culture	Learning can be enhanced by ensuring that it takes place in an authentic context. Mobile devices are especially well suited to context-aware applications simply because they are available in different contexts, and so can draw on those contexts to enhance the learning activity.
Collaborative	Activities that promote learning through social interaction	Collaborative learning has sprung out from research on computer-supported collaborative work and learning and is based on the role of social interactions in the process of learning. Though not traditionally linked with collaborative learning, another theory that is particularly relevant to our consideration of collaboration using mobile devices is conversation theory, which describes learning in terms of conversations between different systems of knowledge. discussions
Informal and life-long	Activities that support learning outside a dedicated learning environment and formal curriculum	Research on informal and lifelong learning recognizes that learning happens all of the time and is influenced both by our environment and the particular situations we are faced with. Informal learning may be intentional, for example, through intensive, significant and deliberate learning 'projects', or it may be accidental, by acquiring information through conversations, TV and newspapers, observing the world or even experiencing an accident or embarrassing situation.
Learning and teaching support	Activities that assist in the coordination of learners and resources for learning activities	Education as a process relies on a great deal of coordination of learners and resources.

III. CASE STUDY

In a previous study, we analyzed how tablet devices could be used as educational tools to support innovative educational practice in a university in Austria. Students and educators were issued tablet devices in 2011 across the full spectrum of programs. Surveys were used to assess the impact of the tablet devices' use on motivation, quality of work, collaboration, achievement, and other factors. More than 98% of all the students worked with their tablets on social media networks, mainly Google+, for group internal communication, and 40% of them had not used social media networks previously for communicating on course related issues. The results of the analysis revealed that 75% of the staff felt that student achievement appeared to have increased since the introduction of tablet devices, mainly in fine arts and business programs. 98% of the students and 64% of the faculty respondents felt that the tablet devices helped the students improve the quality of their work significantly. The majority of educators used tablet devices regularly in their teaching. For IT related programs, the students' performance did not significantly increase by using tablet devices, but 87% of the responding students of IT programs felt that their levels of collaborative working improved. Minor technical issues were faced, mostly due to user error, but were easily dealt with. Considering the outcomes of the previous study it was planned to establish a similar learning environment in a Turkish university but with a modified learning approach. The main research question was: 'Could the flipped classroom approach create a positive leverage effect on student learning outcomes?' For students from two bachelor courses, (1) foundations of information systems and (2) introduction to management information systems, the course syllabus was adopted to integrate mobile learning elements; additionally, the flipped classroom approach was applied. The main benefit of flipped learning is the restructuring of class time, which is more of a pedagogical solution than a technological solution. Nevertheless, in-class benefits are dependent upon the utilization of technology tools, like content creation tools, tablet software, document-camera based solutions and distribution tools [9]. Students had to watch lecture videos outside the classroom (no traditional in class teaching) and focused in class on group work activities, assessments and other online focused activities. For every class the students brought their mobile devices and worked mainly in groups on course related topics. Basically, it was created the same learning environment like the one in the previous study: mobile learning modules (MLM) were created for each course section and integrated in the course syllabus. Like in the previous study it should have been analyzed how student learning changes with the integration of mobile learning elements (MLM).

TABLE II. . STUDENT PROJECT, INCLUDING MOBILE LEARNING ELEMENTS.

Topic	Student project: system analysis and design Main question to be answered	To do list
1	How can we use USE CASE MODELING?	Analyze the primary and secondary sources
2	What is included in a USE CASE SCENARIO?	Find out main categories, details, data types, sources
<i>Use your tablet and find sample applications and evaluate them. Use your tablet and prepare a sample use case scenario. Use your tablet for sharing your designed map with your instructor and the other groups in your course.</i>		

IV. RESULTS

Although the use of computers including laptops is established in schools, the integration of tablet devices in combination with flipped classroom activities is still at the innovation stage. Surveys were used to assess the impact of the tablet devices' use on motivation, quality of work, collaboration, achievement, and other factors. With the integration of mobile learning modules (MLM), the teaching methods primarily used a focus on flipped classroom lectures and MLM, supported by MLM based field analysis and student projects. For mobile learning modules (MLM), the tables issued were used to reach the learning goals that were defined. In the 'Foundations of Information Systems' course, for instance, students used the tablet for the whole course to work on their mobile learning modules: this includes working on their individual assignments as well as on their group projects. For the project, two different streams were important, the students' one and the stream considering the use of tablet devices by educators. The students' stream includes the development of course designs, including mobile learning

modules and focusing on flipped classroom activities, collaboration issues and a technology focus. The mission of this project part was that (1) every student has his/her own learning device, (2) every student uses some kind of technology for every lesson, in class and outside the classroom; and (3) every student can improve his/her learning by using technology. The educator's stream focuses on the motivation of educators to use the tablets not only in class for student active and passive work, but also for educators' active work, in data collection, preparing course content, presenting course content, collaboration with students, and collaboration among educators. At the end of the project, surveys were used to assess the impact of the tablet devices' use and flipped classroom activities on motivation, quality of work, collaboration, achievement, and other factors, both for students and educators. Most instructors created and frequently used a course related circle on Google+ for communicating with all the students, created lecture videos (on average two per week) and Google sub circles for all the student groups working on projects. Some instructors used sparks, which is a customized way of searching and sharing that follows an interest-based approach, to share results with the course circle or any sub circle or selected students Hangouts were used for the online office hours of instructors, explaining assignments, talking about projects, group work or communicating with students completing their projects, facing problems, or needing some kind of support. 99% of all the students worked with their tablets on social media networks, watched the course videos on their mobile devices before they came to class. The results of this analysis revealed that 90% of the staff felt that student achievement appeared to have increased since the introduction of tablet devices and the flipped classroom activities. 100% of the students and 89% of the faculty respondents felt that the tablet devices helped the students improve the quality of their work significantly. All educators use tablet devices regularly in their teaching (outside and in classroom). For both courses, the students' performance increased significantly by 9% on average; and 98% of the responding students felt that their levels of collaborative working improved.

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