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RESEARCH ARTICLE

MOBILE LEARNING FOR GEOGRAPHY EDUCATION IN K-12 CURRICULUM *PROJECTS*

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ABSTRACT

Frequent technological changes have started the persistent changes in the evolution of human society. Unlimited access to the information is evidently the basic and foremost result of these reconstruction. The next change, not less important, happened in the transfer and the presentation of the information and the knowledge. Developments of mobile application technology for K-12 education enabled a new venture by making the learners fully mobile, demolishing the time and space limits. These devices enable the unlimited access to the information, knowledge bases, and multimedia contents and most remarkably to the communication beyond time and space. The article aims to use mobile learning through the integrated GPS tool that enables linking information with spatial patterns while using augmented reality to effectively enhance the development of Geographical competence in teaching and learning process. This paper conceptualizes to replace traditional modes of teaching which used obsolete approaches for landscape interpretation using paper maps leading to pedagogically inflexible and disconnected curriculum design. Engaging students in active learning of geospatial context using the traditional approach based on paper maps is inherently challenging and limited. The research encourages to enable adaptation of transformative learning and self-motivational learning related to the curriculum based in geospatial science with the aim to improve the active teaching and learning of geospatial context using digital content. Is today's contemporary school prepared for the transformation influenced by the mobile technology integrated with GPS tools? How can today's educators respond to the challenges of innovative teaching process through mobile technology in the learning curriculum?. This paper would like to portray and unveil the changes in the educational process influenced by the development of mobile technologies.

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INTRODUCTION

We often see students with tablets and iPads in the 17th or 18th century prototype classroom. Mighty hypermedia gadgetry is often peripheral to didactic guide followed centuries back. Internet and mobile phones are auxiliary tools within the classroom system founded in ancient times. The basic issue today is adjusting digital technology to the needs of educators than to the needs of students (PowerPoint presentations, smart boards). Even today, students are required to follow didactic models by listening and observing what the trainer does. It is highly challenging to attain academic standards with such ancient model. Therefore, we need to ask ourselves: Is there a need for a new reform pedagogy? This paper is specific of the aim of determining whether mobile devices can be effectively used as a GPS tool to enhance the growth of Geography teaching and learning process.

Review of empirical literature: To date, we have done more to adjust digital technology to the needs of teachers than to the needs of students (PowerPoint presentations, Smart boards etc.). Yet, even today, students are generally requested to sit, listen and follow what the trainer is doing. It is a challenge to achieve academic standards that present age society would expect with such didactic models. Over the last decade we have targeted events in the school classroom with respect to the influences of digital communication technology on the transformation of the teaching environment and didactic strategies occurring in the classrooms (Matijević, 2008; Matijević, 2012; Topolovčan and Matijević, 2014). The need of the current age is that we need the didactics of student's work which scientifically explains learning assisted by digital media, since we can learn 'what we want, whenever we want it and where we want'(March, 2006). Additionally, what we need, apart from the artificial intelligence is ability to integrate an empowered natural intelligence with latest digital media that controls learning processes (Topolovčan and Matijević, 2014).March's (2006) statement encourage students to learn in every way possible. This itself manifests that every learner is different; each student learns in their specific pattern, and hencetheir competencies can be grown and developed in multiple other ways. That was confirmed over the last thirty years through psychology of learning (Bransford, Brown and Cocking, 2000; Preiss and Sternberg, 2010). Based on these notions, it is obvious that every individual is holistic in nature and learning is an inherent to survival. An individual learns through collaboration, participation, research activities and creation. Every individual is therefore not only intellectual, but also social, emotional, and psychomotor creature. Humans need learning strategies and situations organized in novel ways. As previously mentioned, due to development of new technologies, primarily Web 2.0 technologies and mobile technologies, learning is possible anywhere and anytime, and about any topic that one can contemplate. Hugger and Walberg (2010) announced that when we append new

discoveries of neuroscience and psychology in learning, we attain what we call "digital worlds of learning". Digital worlds of learning include mobile learning (m-learning).Mobile learning canbe very flexible learning and classroom organization. Such a classroom is individualized and adjusted to the individual capabilities and learners' need. Mobile learning (digital worlds of learning) is characterized by informal organization, cooperation, creativity, redefinition, individuality, small informal groups of students (associates), communication, self-organized learning, and research. The listed qualities of learning and classroom organization, aided by digital media can be explained by the concept "open classroom and open learning" (Gudjons, 1993). Digital worlds of learning and mobile learning as one of its manifestations are, mostly interest groups of associate learners which are formed based on individual interests and needs. Later, these associate learners work together as a cohort on joint issues to develop individually. Mobile learning of any subject, anytime, anywhere, and in every way possible, is based on the constructivist theory of learning (Terhart, 1999; Tobias and Duffy, 2009) and community of practice (Wenger, McDermott & Snyder, 2002).Mobile learning is regulated by learning through research and analytic ability, cooperative learning, learning through games, projected learning and action-oriented learning. Together with the emphasized individual approach and focus on self-realization, these learning strategies can be discovered within the mentioned didactic routes and changes of the reform pedagogy (Skiera, 2009). Didactic characteristics of digital learning significantly correspond to the didactic elements formed by Celestine Freinet, and are related to learning by research, correspondence, agreement, group meetings, free expression, cooperation etc. (Matijević, 2001; Skiera, 2009).

Review of conceptual literature: Mobile learning means continuous adjustment to new achievements in mobile technology, continuous redefinition of the roles of students and teachers, as well as interlacing formal and informal learning. Mobile learning encourages development of life-long learning, necessary in current society. Maximilian Dictionary defines mobile learning as "teaching method and materials including the use of mobile devices or handheld computers." Mobile technology enables uninterrupted entertainment as well as participation in social events aimed towards social groups and individuals based on their inclination. Mobile technology in learning is the key topic of scientific and expert groups. It is beyond any doubt that the capabilities of mobile technology in learning industry are probably the largest so far. ICT technology of the past did not have the capabilities and characteristics of today's mobile technology, which makes them more alluring to all the players in the learning process (Ally, 2009).Students' interest in use of smart phones and tablets is an opportunity to build novice and inspiring educational experience in the school classroom. However, the question is whether our schools are capable to accept and further develop the possibilities which are already present in the classroom? It is interesting to note that, schools are continuously complaining about inadequate ICT equipment as lack of equipment is very often a good excuse for not using the ICT equipment in the classroom (Leask & Meadows, 2000). In recent days, students often have brand new mobile phones, and they can access the network resources, which mark the mobile phones as a potentially interesting classroom technology. Unfortunately, schools forbid the use of mobile gadgets in the classroom. Schools are directly ignoring the available technology and skills owned by students, which are indeed necessary for the society of the future. When asking teachers for their opinion on the topic of using mobile phones in the classroom, they are generally skeptical and believe that such use is neither pedagogical nor didactical. It is surprising that there is a believe that mobile phones can only "interrupt the teaching process." Some teachers accept the possible prospects provided by mobile technology however acknowledge that they lack the required training in their use while teaching (Buehl, 2013). A few teachers can be called "traditional teachers" because they oppose the modern technologies in the re-fashioning, reorganizing and implementation of the teaching process. This paper aims to highlight the possibilities of using mobile devices and mobile learning in Geography education in K-12, while enhancing the learning process, it is important to consider the best characteristics of mobile devices.

New generation students notably differ from students of the past. They are, the so called, digital natives (Prensky, 2001). Mobile technologies, through their evolution and countless possibilities, confirmed the requirements and expectations of digital natives, especially in all forms of education and communication. Mobile phones offer students with easy and flexible access to information and prepare content in a diverse and more "personal" way, while at the same time imparting new skills for the future. Therefore, mobile technology has the potential to motivate budding learners who perceive the world as an open classroom. It is therefore reasonable to question ourselves how can we define mobile learning in a way that is not closely tied to a physical device?

Research Problem: The specific issue that the paper addresses was lack of empirical research in identifying applicability of mobile devices in GIS (Geographic Information System), augmented reality, and GPS (Global Positioning System) tracking in outdoor mobile learning educational settings at a metacognitive level. Engaging students in active learning of geospatial context using the traditional approach based on paper maps was inherently challenging and limited especially when learning of spatial context was limited with computer-based E-learning. With the aim to improve the active teaching, Mobile learning using GPS tracking, related to the curriculum based geospatial context which utilizes digital content like thematic maps of soil, hydrology, vegetation, geology and climate in Geography education was made feasible, but trainers were initially hesitant due to lack of technical knowledge and fear of obsolescence of traditional teaching methodology.

Research Objective: Digi-Mapping project was crucial to offer flexible learning modalities through a mobile application, e-learning modules and a 'moodle' online course to achieve a conceived curriculum that reflects the needs of professionals working in the contemporary domain. Digital maps using mobile technology promotes synchronous communication and can substantially improve experience of students in remote field settings. The purpose of the study was to improve encourage future learners and teachers in remote field settings related to GPS using mobile and online learning to help learners interpret how spatial relationships interrelate to help in effective assessment and management of resources. Previous literature emphasized on the limitations of teaching GPS by lecturing instead of using authentic interactive environments for knowledge sharing in remote field study experience. The literature indicates that teaching and learning related to global positioning system (GPS) is effectively delivered in real life situations through real-time environments using technology rather than just in classroom environment. The purpose of this article is to determine whether mobile learning can improve the learning of remote field study experience through analysis of superintendent's feedback.

Theoretical Framework: There is an interesting form of BYOD model which enables the students to bring their own device that they use at home with the family, or their personal device for outdoor mobile learning(Caldwell & Bird, 2015). Schools that choose this BYOD model had developed the network infrastructure to create an environment capable of accepting various devices. The use of management games in learning provided the students with the opportunity to learn new contents and achieve new competencies to ensure better participation of students, exchange of ideas, collaboration, expression of opinions, empowering of communication, etc. (Kapp, 2012).We should remember that, unlike computer classrooms, used primarily by the computer science teachers, tablet labs can be used in all subjects and classes. Tablet labs cannot be reserved for one subject, because its concept and abilities could provide identical results for nearly all subjects in elementary school (Beauchamp, 2012). Therefore, we can conclude that tablets have great potential for the integration into the school's curriculum. An additional argument for integrating tablets into the curriculum is the need of today's digital natives who sit in the classrooms. The use of specific tablet classrooms should not satisfy today's learning process as it does not provide the same opportunities for all students (Bidarian, Bidarian, & Davoudi, 2011).

From a technology stance, the use of mobile devices assumes the possibility to access information, communication, resource sharing, continuous connection, battery use (use of device), size of the monitor and of the device. Mobile devices offer students various possibilities in everyday life which should be focused on education (Woodill & Udell, 2014), in fact in outdoor learning as well. If we want to define Mobile learning without the connection to the technical device was necessary to consider the possibilities, new experiences and opportunities offered by the evolution of educational technologies, which, upon request, could create a personal world filled with tools and resources, aiming to develop personal knowledge, fulfilling personal needs and interests, and complete or partial cooperation.Literatures draws either a direct or an indirect relationship to the overarching question of application of mobile learning in remote field training. The primary focus areas of research become visually observable with the literature map. Teachers could effortlessly create educational materials (presentations, photo-albums), or use applications to boost specific educational content, such as GeoGebre6 for Mathematics, or Google Earth7 for Geography, science etc. based on the GPS tracking system.

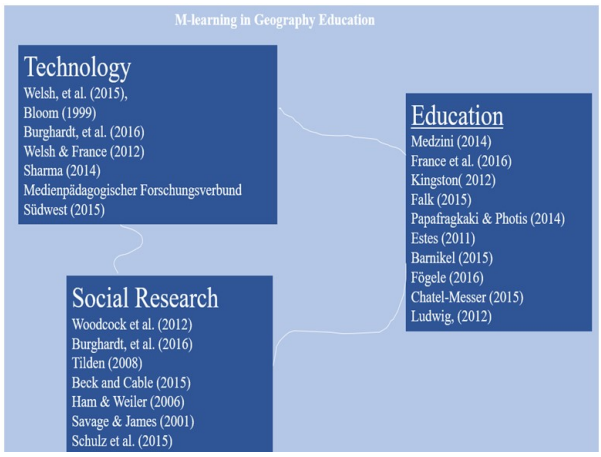

Figure 1. Literature Map

Research Significance: A tablet or smartphone was found to be an essential teaching aid and assistive tool to teachers when displaying multimedia content in a classroom, for administering educational process, accessing students' work, interacting with students, designing of educational content and personal development activities. Similarly, geospatial context which utilizes digital content like thematic maps was used for in-school project like garbage monitoring system for GPS tracking in outdoor mobile learning within the school. It was vital to highlight the student prospects and liaison with parents as well. Schools are now equipped with high-speed network connections within the campus and have equipped their classrooms with the required count of laptops or tablets. Teachers obviously use technological equipment like remote sensors to track student attendance in class. Providing tablet devices with access to context enabled smart phone applications to learners who select and analyze spatial information using integrated navigational software with inbuilt artificial voice routes and GPS receivers with larger datasets stored in the cloud database. This outdoor school project on garbage monitoring was suggested to widen student's cognitive ability, spatial orientation competence, and develop sense of social responsibility as well. The Spatial Citizenship approach (Schulz et al., 2015) was fully met by this project. It´s main goal was "using digital geo-media to promote self-responsibility in social participatory processes". Teachers could be offered various possibilities for evaluating thesame digi-mapping mobile app installed in students' handheld devices and personal computers. Augmented reality was used to show the geological layers in the field. The apps include, on one hand, the geographic data with the coordinates of the points of interest (POI) and, on the other hand, the captured photos which presents the contents related to the POI. Equipping each student with same type of devices like tablet computer or a smart phone during and after this school project was essential.

The BYOD model (Bring your own device) encouraged in numerous schools in USA (Woodill & Udell, 2014), was most motivating and the most advanced way of using tablets andiPads in teaching. Unfortunately, due to the high expenses, especially for state schools lacking sufficient resources, this approach was followed for school projects. However, uniformity was ensured by the school for all students with all tablet devices of equal performances and characteristics, such as the operating system, screen resolution, autonomous batteries etc. It is important to say that the teachers and school administrators were the project leaders responsible for installing sensors in the garbage bins in the school campus and feeding the installed app with appropriate project data. For technologically supported school, devices offer great capabilities for the preparation and design of educational material, communication, and implementation of the educational process. However, for complete implementation, it was highly recommended to integrate technology completely into the curriculum (Woodill & Udell, 2014). The study used a consumer-based app installed in mobile devices to substantially integrated to the learning process to produce information like map creations and measurements, surveying and development of smart phone apps using camera, geo-tagging functions, text tools and creation of augmented realities by integrating sliders in smart phone apps. This approach supplied multiple possibilities for interactive design and use of multimedia audio and video materials, potential use of problem-solving learning, active blended learning, use of flip method for reverse classroom learning i.e., learning of updated content and communication outside the school through projects, online access to the learning materials etc. (Bergmann &Sams, 2012)."Mobile outdoor learning has the capacity to combine the achievement of subject-specific knowledge (understanding space and place, interrelations and systems etc.), with spatial orientation (real world orientation, map reading and construction, spatial perceptions) and the collection of data based on subject specific technologies (GIS, GPS) to display varying topics containing information about natural and cultural phenomena of different aspects of geomorphology, climate, settlement patterns, historic buildings and sites etc." (Chatel et al., 2017).

Research Questions: The overarching research question that this article addressed was "Can Mobile instruction delivery through digital maps be applied to impart hands-on remote field training activities to improve active collaborative learning experience for K-12 students in geospatial context?" The research questions were developed based on curricular activities, brainstorming, peer-review and the development of a planning matrix to aid in the final development of questions for this research: Specifically, how M-learning improves conceptual foundation for interpretation of mapping and resource management processes using hand-held devices.

RESEARCH METHODOLOGY

The installed app was intended to integrate handheld device like tablet into geography education to build various subject specific key competences for recognizing natural and social interrelations in spatial and systematic contexts. The research method is founded on grounded theory and can be also be utilized in qualitative work, including ethnography and phenomenology. The research synthesis was done through literature survey and validated based on supportive exploration of documents collected from the school district superintendent's office. Participants could generate specific characteristics of the geographical POI in a round-robin manner for the allotted project and update them based on expert feedback. All garbage bin locations were embedded into an orientation system, maps and GPS coordinates were provided and direction guide from one location to the other were automatically generated. The development of a planning matrix helped in identifying how M-learning improves conceptual foundation for interpretation of mapping and landscape processes using hand-held devices.

Research Findings: Learners were enabled with well-developed conceptual and technical knowledge to use mobile devices as productive and constructive tool for practical hands-on activities and improving cognitive competence by collecting, analyzing, and selecting information. The results indicate a willingness and interest in mobile technology on the part of students. The superintendent agreed that students' willingness and use of mobile devices increased over time. When evaluating proficiency in the use of digital maps in the field, resulted in correct completion of mapping activities yielding an overall average of 93 percent. Moreover, aspects of both transformative learning and self-motivational learning were depicted in these responses. Records indicated that students felt that mobile learning could contribute to other K-12 courses. This feedback encourages future development of cross-functional curricula by expanding mobile learning. The researcher's argument was well supported by the findings of knowledge attainment as the high performance among students while using digital maps with positive feedback about Digi-mapping was the value achieved of curriculum content. This collective evidence becomes a strong argument for the continued use and expansion of mobile learning in this specific context as the overall attitude towards mobile technology had a positive correlation with other feedback and results in the post-course phase. The findings depicted an extent of visualization of the outcome and strongly supported how it correlated to the aim of the study.The advantage of combining real world phenomenon with additional background information accessible via mobile devices enabled the integration of augmented reality for easy comparisons and to understand changes in spatial patterns over the time. Previous studies were largely included to relate to the findings and prove them important in the aim to revisit the issue. All processes and results were consistently evaluated based on evidence.

Conclusion of Findings

The multiple positive results obtained through data analysis suggested recommendations made for an improvement of Digi-Mapping teaching tools for further exploration and application in near future. There was a strong indicator that students were highly motivated towards the use of their mobile technology (smartphones/tablets) into their future study involving GIS and remote sensing since they have already use them in their current study. The limitations of this study were restricted financial resources, availability of participants, and time necessary to develop specific technologies. Capacity building in the geospatial industry and the use of mobile technology at the intersection of pedagogy and mobile learning, as well as proving the advantages of blending different learning technologies in geospatial science education (Gewin, 2004; Horák, 2015). In contrast to previous traditional approaches teaching geospatial context using paper maps, this study implemented a blend of interactive eLearning modules and geospatial mapping applications in remote field activities, enhancing the educational experience for students. Advancements through education effectiveness was possible by broadening the scope of self-motivational and transformational learning. This article thoroughly aimed to illuminates, the capacity of "anytime anywhere learning" at an affordable capacity by students and educators for collaborative learning.

Reflection and Summary

It was observed that there is no such prior investigation study that covered all the addressed factors discussed in the literature review of this study. The capabilities of tablets in mobile learning and training supplied depend on the pedagogical approaches and readiness of trainers, experts in teaching and didactics, to integrate tablets into the learning process. It was essential to highlight that "traditional" didactics cannot stand up to the challenges of mobile technologies and possibilities of their use in the preparation, implementation, and evaluation of the learning process. The use of gamification method could prove to be interesting in future as well help in providing the students with the opportunity to learn new concepts and attain new competencies through games to ensure better participation of students, facilitate exchange of ideas, collaboration, expression of opinions, empowering of communication, etc. (Kapp, 2012).We need to be willing to accept new educational possibilities offered by information and communication technologies, for conducting necessary changes. We need to develop didactics of student-oriented learning, constructivist didactics and constructivist teaching method. Finally, it should be remembered that the prospects offered by mobile learning are not the remedies for all the problems of educational systems around the world, however, they do stand for a powerful and revolutionary solution.

Scope for future research: The current trends of mobile learning for promoting digital citizenship approach to learn about local and global phenomena was encouraged through this study. We found that future citizens were interested in accomplishing deeper insights into their living environments. Smartphones and tablets can be motivating for students as they offer a vast range of opportunities to negotiate between subjective realities and electronically constructed information through augmented reality. The research can serve as gate openers for future researchers to navigate from reality to virtuality in combination with a modern and innovative digi-mapping mobile apps has a promising future. The combination of outdoor experiences and exploration with theoretical knowledge can support the development of cognitive competences and technical skills. GPS and map resources allowed the development of the competence of spatial orientation which can develop geographical key competence and lead to deeper understanding of landscapes and cultures. Learning activities with manifold contextual framework, for the planning process of Mobile learning can shift from educators to hands of learners once they are familiar with the possibilities. There is still a lot of research work to be done to gain better understanding of e-learning and mobile learning related learning psychological phenomena. On expanding the study, it can be possible to analyze how to make advancements in outdoor learning. This article thoroughly illuminates, the attitude of smartphones users on "anytime anywhere learning" at an affordable capacity on students, citizens, and educators for outdoor learning.

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