USE OF MOBILE TECHNOLOGY IN THE TEACHING/LEARNING PROCESS: OPPORTUNITIES AND BARRIERS

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Abstract: Nowadays, mobile devices are able to support a large diversity of tasks being used for communication, socialization, interaction, collaboration, sharing of information and resources. As already known, mobile phones became active parts of the lifestyle of many teachers and students. The powerful capabilities of mobile devices and the increasing number of educational applications opened new perspectives for the integration of cell phones in the classroom. Mobile learning provides various opportunities for teachers to increase students' motivation, individualize the teaching process, and extend it outside the classroom. However, there is a long journey for mobile devices to become common tools, successfully integrated into the teaching and learning process. Despite the new opportunities and perceived benefits, there are also barriers to integration. These barriers have been broadly classified as external and internal. A key issue takes is the teacher's willingness to incorporate mobile technology into their own teaching demarches. But this decision depends on each teacher's personality, attitude, and perception concerning the effectiveness of exploiting the mobile technology facilities in teaching and learning. In this respect, this paper aims to explore the perceptions of Romanian and Lithuanian science education teachers as regards the opportunities and barriers of using mobile technology in education. The results show that overall, the teachers from both countries have a positive perception concerning the opportunities provided by mobile technology and a similar concern as regards the potential of its inappropriate use. The results also revealed a diversity of perceptions related to the teacher's personality, individual teaching practices, and existing technical support.

Keywords: mobile learning; mobile technology; educational opportunities and barriers.

I. INTRODUCTION

With the explosion of mobile technology, mobile phones are no longer used only for communication. Rather, mobile devices tend to replace personal computers with more versatile tools that are also used for socialization, interaction, collaboration, entertainment, sharing of information and resources. The development of social media technologies, especially social networking websites has accelerated this process. People are using mobile devices almost everywhere: at home, at work, in school, on the bus, on the train, in parks, and even when walking on the street [10].

Using a mobile phone is now part of the lifestyle of many teachers and students. This creates opportunities for purposeful use of mobile technologies in education. For the teacher, mobile

technology provides new ways to increase students' motivation, individualize the teaching process, and extend it outside the classroom [14]. For the teacher and the learner, the mobile devices provide learning affordances that help the teaching and learning process [12, 14]. This sounds like an inevitable issue for the future so that the use of mobile technology will be an inseparable part of the educational activities.

The use of mobile technology in learning represents an important concern from more than two decades [2, 3, 4, 5]. However, things are changing slowly. There is a long way from using the mobile phone as a tool for a purposeful integration of mobile devices in teaching and learning. A key issue is the willingness of teachers to do this, which, in turn, depends on their personality, attitude, and perceptions as regards the effectiveness of teaching and learning. Those perceptions depend on a diversity of factors that are hindering or limiting the use of mobile devices for teaching and learning.

The context is not clear in many countries since the use of mobile devices in the classroom is a controversial issue. As pointed out by Thomas et al. [14], although historically the cell phones have been perceived as a disruption, the perception changed in the last decade after due to the perceived benefits of using powerful technology. However, the negative effects of the excessive use of social media by students have led to banning mobile cells in many countries, especially for very young students. In this respect, weighting the opportunities and benefits of using mobile technology in schools as well as looking for ways to overcome existing barriers became a critical issue for education.

This work aims to explore which are the mobile devices used by teachers, how teachers value the importance of such technology for education, and which are the factors that are hindering or limiting the use. To do this, a qualitative approach has been taken that is based on a questionnaire with open-ended questions. The questionnaire has been administrated to a sample of 16 science education teachers from Romania and Lithuania.

II. RELATED WORK

The use of social media and mobile Internet increased dramatically in the last two decades [L10]. Using social media on the mobile phone became part of the lifestyle of many people, including teachers and students. [14]. Despite the new opportunities and perceived benefits, there are also barriers to integration that have been classified in two broad categories: external (lack of access to technology, funding, time, institutional context, and technical support) and internal (knowledge and skills, teachers' beliefs and willingness to change) [3, 5]. More recently, Tsai and Chai [13] identified a third-order barrier related to design thinking for teachers (adapting the instructional needs to learners).

There are many opportunities for the integration the mobile technology in education. According to Thomas et al. [14], mobile devices can support a diversity of educational activities such as communication with and between students, interaction, collaboration, fast access to resources, lesson preparation, homework presentation, and evaluation. Teachers are currently using mobile technology for school-related work. The main cell phone features mentioned in their study were the camera, clock/alarm, timer, e-mail, and texting. Their study surveyed 79 teachers and found that a large majority of them (79%) are in favor of using cell phones in the classroom. The main barriers identified were the lack of access and class disruption.

The study of Hew and Brush [5] analyzed the barriers to integrating technology in schools and strategies to overcome these barriers. Their study based on a review of existing research identified six categories of barriers: resources technology, time, and technical support), knowledge and skills (about a specific technology, technology-based teaching, and technology-related class management), institution (leadership, inflexible timetable, and school planning), attitude and beliefs (pedagogical beliefs, technology beliefs), assessment (pressure of tests, use of technology merely for assessment than for teaching and learning), and subject culture. Their study identified five categories of strategies to overcome these barriers: shared vision and technology integration plan (how to enhance learning, relationships between technology and content areas, how to implement the change), provision of needed resources (flexible time-table, the involvement of students, collaboration), changing the attitudes and beliefs, conducting professional development, and reconsidering assessment.

Kumar et al. [8] argued that mobile learning could improve education in developing countries especially for rural students for which formal schooling is not the most convenient. Cellphones which are seen as personal computers in the developing countries may facilitate informal learning out of school thus complementing formal education. The noticed that cellphones contribute to the development of social relationships in the learning context (social learning).

Kopcha [7] analyzed the perceptions of teachers as regards the barriers against integrating technology in teaching and learning. The participants were teachers under situated professional development for two years. The findings show that situated professional development plays an important role in changing teachers' perceptions of the barrier and shaping their beliefs about technology. The time has been perceived as an important barrier and is explained by the time-consuming activities required for effective integration. Another finding of this study is the fact that professional development delivers outcomes over time.

An important opportunity for integrating mobile teaching and learning in schools is related to BYOD (Bring Your Own Device): a technology model-based that requires students to bring their own devices in school [12]. In his study, Song [12] argued that this model creates a seamless learning environment that may benefit from the affordances of mobile technologies provided that learning is mediated by an adequate pedagogical design. Such affordances of mobile devices include tools for multimedia access and collection, communication, resource sharing, and representation.

Joyce-Gibbons et al. [6] analyzed the potential of BOYD learning in rural Tanzanian schools. Based on the analysis of teachers and students perceptions, they identified several barriers: a potential of the digital divide (students that don't afford their own mobile device), misuse of mobile devices by students, hostile school policy (banning the use of mobile devices in school), and a negative perception of teachers as regards the value of mobile phones as educational tools. In fact, the school policy teachers' opinion is convergent and express the fear that bringing the mobile in school may lead to disruption of lessons and possible misuse.

Montrieux et al. [11] took a qualitative approach to explore the introduction of tablet devices in secondary education. They identified two kinds of teaching styles: instrumental and innovative. The study mentioned several opportunities created by the device: a wider range of educational activities increased students' engagement that is acting as active learners, extending the learning outside class, possibility to take pictures and integrate notes, easier communication and collaboration between students, and reducing the weight of schoolbags. As barriers, the study mentioned: lack of adequate infrastructure, the lack of content, lack of specific professional development, lack of technical support, higher workload, and use of devices by students for games.

Burden and Hopkins [1] analyzed the barriers and challenges of using mobile technologies for teaching and learning as perceived by pre-service teachers. They carried on longitudinal research over an academic year by collecting data in three phases: induction, midpoint, and exit. They found that students have a positive attitude towards technology and they are confident in their self-efficacy in using mobile technology, although more for learning than for teaching. Most of the students were convinced that preparing them to use technology for learning in university would be beneficial. The main first-order barriers identified during the study were infrastructure, school cultures, technical issues, time, and external support. As regards the second-order barriers, students expressed fear about the rapidity of technology development and concern about the student misuse of mobile devices.

The study of Vongkullusn et al [15] analyzed the teachers' internalization of external barriers and the externalization of personal beliefs in the process of classroom technology integration. Internalization refers to the gap between the resources provided by the school and the teachers' perception of school support to overcome the first-order barriers which may be influenced by the teacher's personal beliefs about the technology. The authors developed a conceptual model that hypothesizes that the effect of school support on classroom technology integration is mediated by the value beliefs and the perceived support of first-order barriers.

Recently, Leem and Sung [9] analyzed the role of teachers' beliefs in the context of technology acceptance of smart mobile devices in South Korea. They argued that teachers' beliefs and smart mobile technology acceptance can act in both directions, either as facilitators or as barriers. Their study found that a major barrier could be the teachers' belief that smart mobile devices are unstable or uncomfortable.

III. RESEARCH METHOD

3.1. Instrument

This exploratory research is part of a larger study aiming to understand the use of mobile technologies in the educational process. Based on the results, research hypotheses and research questions will be formulated and a quantitative research instrument will be developed.

This research is qualitative, of a preliminary type. A questionnaire with several open-ended questions/tasks has been administrated to participants. In this work we will focus on the following three research questions:

- What mobile technologies/devices do you use in the teaching process?
- How to make meaningful use of mobile technology/devices in teaching/learning?
- What hinders/limits the use of those technologies/devices in the teaching process?

The research data were expressed in written form. The qualitative data were processed using content analysis.

3.2. Participants

The data has been collected in September 2019. The questionnaire has been answered by 8 teachers (3 males and 5 females) from different Lithuanian schools. The age of participants ranges from 30 to 50 years old (M=42.38, SD=5.83). The participants have qualifications in physics (2), geography (3), chemistry (1), biology (1), and ICT (1). As a professional rank, there were 4 teachers, a senior-teacher, a teacher methodologist, and two teacher-experts.

In Romania, the questionnaire has been answered by 8 teachers (2 males, 6 females), teaching physics (4) and chemistry (2), and 2 teacher-experts with a qualification in sciences. The age of participants ranges from 36 to 63 (M=49.38, SD=8.63).

IV. RESEARCH RESULTS

4.1. Lithuanian teachers' position

All the respondents in different levels are using mobile technologies/devices in the teaching/ learning process and positively value their application. However, almost everybody notices that permitting to use mobile phones in the teaching process, students very often overindulge in this, i.e., do not work with the program that is needed, but, e.g., go to social networks (Facebook), or some other game programs. Below (in Table 1), there are generalized teachers' comments on the aspect of every variable.

Variable	Answer
The use of mobile technologies in the teaching process	Used devices: • iPads • Mobile phones • Smart bracelets • Einstein's computerized laboratory (a small choice of measurement elements) - used very rarely Used technologies (using the internet - wi-fi, mobile data): • Various computer software programs (applications) • Computer teaching devices - Encarta, Fizika v kartinkax, Crocodile Technology, Model Builder, Interactive physics • Real image models, such as Google Earth, Google Maps and so on, geographical information systems (GIS), maps - usually ArcGis (world) or Akis-M (Lithuanian) • Social networks (e.g., Facebook)

	• Video storage platforms,
	• Document creation Windows tools or websites so-called "Blogs"
How to make meaningful use of mobile technologies in teaching/learning	Teacher personality: • Using ICT, one has to pursue general education programs; • The teacher has to have quite a lot of knowledge; • The teacher has to meaningfully motivate the students. Computer software programs (application software), platforms: • Quite a lot of platforms are created, which can be used; • Trying to use teaching programs that can be easily found on the Internet. It is the very convenient way - for example - when estimating length, mass, temperature, volume, force measurement absolute bias; recognizing and distinguishing thermal and mechanical movement, getting acquainted with the phenomena of light; • Several applications are used, which allow more vividly to convey the topic - students better understand the teaching material (e.g. QR reader, termocamera, planimeter, sound meter and so on); • It is convenient when applications are corresponding or imitating complex and expensive appliances - a real help for performing research in the lessons. Teaching process part: • Performing information search, data internet access, statistical data access; • Quicker and more effectively conducting students' questioning and performing tests; • Consolidating the learned information; • Students quicker performing self-evaluation during the lesson - it is convenient to use the phone with the internet for self-evaluation, where one can use certain computer software programs; • Learning results presentation becomes more vivid and more understandable; • Improving students' and teachers' communication in the virtual space.
Factors limiting/hindering the use of mobile technologies in the teaching process	Teacher personality: • For many teachers, particular skills are still necessary. • Senior age pedagogues might lack computer literacy knowledge. • Computer lesson preparation is difficult - it is a matter requiring a lot of time for preparation. • Thinking that it is not important. Technical provision: • Mobile device shortage. The school does not fully provide mobile technologies. • Not all students have mobile phones (especially in the village schools, of course, not a big part of students have this problem). • Not all students have the possibility to use the internet on their mobile phones. For many students, having connected to one program at the same time makes the speed slows down, it starts to crash. • Students' available devices are on different capacities (maintaining not all programs, in different operational systems (OS), different programs that operate). • Internet interference. Not in all places at school, there is access to a free of charge internet. • Lack of financial resources at schools or different allocation of them. Inappropriate use of mobile devices in the education process:

Variable	Answer
	• Students sometimes use mobile phones, not for task completion. During the lesson, students like to overindulge, do not work with the program which is required but e.g., turn on Facebook or other game programs. • Students' obsessive inclination to social networks.

<div align="center">Table no. 1. Lithuanian teachers' position</div>

Lithuanian teachers noticed that in the teaching process, they use mobile devices and technologies available at their school and personal students' phones. Having generalized the teachers' opinion about mobile technologies as meaningfully used in teaching/learning, it emerged that this is determined by two important aspects, i.e., the teacher personality (his/her preparation and abilities), appropriate choice of teaching digital tools, appropriate use in the teaching process, and communication in virtual space.

4.2. Romanian teachers' position

All the respondents in different levels are using mobile devices in the teaching process and expressed a positive perception about their application in teaching and learning. Below (in Table 2), there are generalized teachers' comments on the aspect of every variable.

Variable	Answer
The use of mobile technologies/devices in the teaching process	Used devices: • iPads • Mobile phones • Smartphones • Tablet • Intelligent blackboard Applications: • Google Classroom, Kahoot • Educational software. • HP Reveal
The meaningfulness of using mobile technology/devices in teaching/learning	Teaching process part - mainly seen in the blended learning format: • Access to Internet resources, updating knowledge • Homework, presentations of students, and evaluation • Didactic video clips/movies • Virtual experiments, simulation of phenomena and device functioning • Case-studies • Individual or group applications, portfolios and projects • Using creative writing, coding, augmented reality • Communication with and between students, collaboration
Factors limiting/hindering the use of mobile technologies/devices in the teaching process	Familiarity with mobile technology: • Few teachers skilled in mobile technology • Students' good skills • Teacher's resistance or inertia Technical provision: • Unequal or limited access to ICT • Difficulties related to understanding and proper use of educational software/platforms • Lack of educational software • Lack of or poor Internet Wi-Fi connection in school Excessive use of mobile devices in the education process • Lack of interest in physical books • Lack of attention in class

<div align="center">Table no. 2. Romanian teachers' position</div>

The answers are quite diverse. However, two teachers mentioned that meaningful use of technology means to integrate the mobile technologies in the teaching process, in certain moments, to improve teaching. All teachers agreed that mobile technology/devices are increasing learning motivation if not excessively used. Teachers considered mobile technology as a useful teaching and learning support.

4.3 Discussion

Generalizing teachers' remarks presented in the table, one can claim that teachers use both laptops and iPads, as well as students' smartphones and mobile computer systems (GLX, Nova, Einstein, and others) in the education process. Using mobile devices, they apply various educational programs (applications) in the lessons, use digital teaching devices and textbooks. Teachers from both countries mentioned the use of geographic data and Internet applications. Lithuanian teachers also mentioned social networking platforms and blogs and Romanian teachers mentioned Google Classroom and Kahoot.

Teachers from both countries valued the opportunities created by using mobile technologies for communication and collaboration with and between students, information search, knowledge consolidation, and evaluation. Lithuanian teachers mentioned as meaningful the use of mobile devices for student self-evaluation purposes. Romanian teachers expressed interest in the opportunities to provide virtual experiments and simulation of device functioning. They also considered meaningful for the teaching process the presentation of homework by students and the possibility to use didactic video clips.

As regards the first-order (external) barriers to use mobile technologies teaching, teachers from both countries mentioned: poor or lack of Wi-fi Internet connection in school, unequal or limited access of students to mobile devices, and lack of the school financial resources for acquiring mobile devices and educational applications. Teachers from both countries mentioned as second-order (internal) barriers the ICT skills, the resistance/inertia to change and the potential of misuse of mobile technologies by students. Lithuanian teachers also mentioned the need for training in how to use ICT for teaching and the time-consuming activities needed to prepare such a lesson. Romanian teachers also mentioned the potential of disruption in class and the difficulties to understand the use of educational software.

As most of the questioned teachers stated, seeking for the use of MT may be meaningful in the education process, but also there are important aspects that must be taken into consideration: teacher's personality itself, what teacher's MT usage skills are, how the teacher is capable to select digital teaching/learning devices, how appropriately he/she uses them in the lessons, how he/she manages the education process itself. Many teachers still expressed an important lack concerning MT usage skills, but also the lack of time for the development of those skills. Besides those mentioned aspects, insufficient school provision with mobile devices, Internet access also limits the proper MT usage in the education process. However, teachers pointed out an important fact directing to the inappropriate mobile devices use in the education process, like the main MT usage hindrances in teaching. Students quite often use mobile devices (especially their mobile phones) not for accomplishing tasks, not for working with the needful program, but for accessing the personal social sites or network links, or game programs.

Overall, the findings of this work are consistent with the results of other studies as regards the opportunities and the main barriers related to the use of mobile technologies in teaching and learning [3, 7, 11, 14]. On the one hand, there are inherent limitations of this exploratory work. The sample in each country is small and mainly oriented towards science education. On the other hand, having answers from the two countries represents a strength since it brings a broader view of the teachers' position. However, it is obvious that for proper integration of mobile technologies in the education process, in both formal and non-formal demarches, an important demand is the strong need requested by the teachers for continuous professional development - in essence, the acquiring of powerful technological and pedagogical skills.

V. CONCLUSION

The results of this exploratory study revealed that teachers from Romania and Lithuania know the educational opportunities created by the advances in mobile technology, value a meaningful use of this technology in school and are aware of several external and internal barriers to the integration of mobile devices in the teaching process.

All teachers who participated in the survey use mobile technologies/devices in the teaching process at a different level and positively value their usage. Teachers use both laptops and iPads as well as students' smartphones and mobile computer systems, using Internet access for this issue. Teacher's personality determines meaningful MT usage in the education process. This depends on the teacher's MT usage skills, teacher's abilities to select digital teaching/learning devices also on the knowledge to appropriately use them in the lessons, and teacher's abilities to manage the education process itself.

The main mobile technology/device usage hindrance in the education process is the lack of teachers' MT usage skills and short time for the development of these skills. The other limiting aspect of no less importance of the MT usage in the education process is represented by the insufficient school provision with mobile devices and limited Internet access at a proper speed.

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