Abstract

The implications of mobile technology in the teaching-learning process were determined, on the one hand, by the occurrence and rapid evolution of mobile devices and, on the other hand, by the growing use of these devices by current generations of students in their individual activities. It is obvious that these aspects are supported by easy internet access. In this context, the integration of mobile technologies in the instructional process for higher education has become an intensely discussed subject in recent years, thus expanding the research in this direction. These implications have led to the emergence of new concepts: e-learning and m-learning, which can be seen both in terms of individual learning activities of the student, and from the perspective of the educational process. As alternatives to the traditional educational process, the integration of mobile technologies in training activities in a constructive manner requires taking into account students' preferences regarding the use of mobile devices in their learning activities in class. This paper analyses the preferences of students from several faculties of the University Politehnica of Bucharest for use of mobile technologies in their learning activities carried out in the classroom. A survey achieved based on the analysis of the answers obtained from focus groups was applied. This paper presents useful information for teachers which can apply it in the design and organization of teaching activities in relation to student's preferences.

Keywords: Mobile devices, m-learning, technology, educational activities.

1 INTRODUCTION

The intense use of mobile technology by students in informal environments, and especially the use of mobile devices in the individual learning process, has raised an interest in integrating mobile technology into the instructional process.

In recent years, schools have shown openness to the use of mobile technology in the educational process, which has led to the emergence of many opportunities that support differentiated and customized learning activities [1].

As a result of these changes, the concepts of e-learning, and m-learning have emerged. M-learning is characterized by learning being done by accessing information on mobile devices at any time, in various contexts [2]. Thus, m-learning occurs both in formal and in informal environments.

Based on a study on the integration of m-learning into the educational environment, Chang C.S. et al. (2011) recommended that schools be endowed with mobile technology that teachers can creatively integrate into the educational process. Thus, students can benefit from a wide range of learning experiences that would help them improve their learning abilities [3].

Almaiah M.A. et al. (2016) appreciates that the main factors ensuring the high quality of m-learning in the context of instructional learning are: "content usability, content relevance to learning activities, functionality, accessibility, interactivity, interface design, ease of use, availability, customization, responsiveness and trust" [4].

In the higher education, the use of mobile devices can bring multiple benefits such as: it can facilitate the development of application activities and can contribute to increasing the degree of participation of students at the activities [5], it can increase efficiency and motivation of learning [6], it can improve critical thinking [7], etc.

In a recent study, X. Yang, X. Li and T. Lu (2015) show that the way the mobile phone information is presented influences students' concentration and their acquisitions in learning; in the selection of the m-learning resources factors should be taken into account, such as: degree of concentration, student interest and mode of presentation [8] etc.
The didactic strategies that use mobile devices are highlighted by how the teacher organizes his/her didactic activity, giving teachers new opportunities to organize learning activities [9]. The application of these strategies in class is reflected in: the manner of presentation of the information using mobile devices, the types of tasks offered to the students as practice activities, in how the teacher coordinates the application activities performed with the use of mobile devices, etc.

To improve the quality of the educational process through the use of mobile devices, teachers have to hold, besides possessing specialized knowledge, and some digital skills. Moreover, taking into account the students’ preferences about classroom learning using mobile devices can be of help both to the teacher and to the student.

Thus, the present study analyses students' preferences on the use of mobile devices (tablets, laptops, smart phones, iPads, notebooks) in an instructional context specific to the disciplines of the technical studies.

At the university where the participants in this study go, teachers explore various techniques for integrating mobile devices into the learning activities. In this respect, for the effective integration of mobile technology in the educational process, it is important to know students preferences and, in particular, their needs.

2 METHODOLOGY

Use as many sections/subsections as you need: Introduction, Methodology, Results, Conclusions, etc.

135 second year students from 5 different faculties from a technical university in Bucharest took part in the present study.

In carrying out the present research, a qualitative approach was pursued which consisted of two stages:

- In order to collect the information necessary for the opinion questionnaire, a focus group was applied to a number of 15 students from the second year of study. The answers from the focus group have helped identify students' concerns regarding the use of mobile devices. The purpose of the focus group was to explore the past experiences of using mobile devices in class and their influence on their own learning process. During the application of the focus group, the interviewer guided the entire activity by addressing the appropriate questions, facilitating discussions between the participants and keeping them in the area of the subject in question. Discussions carried out within the focus group were recorded and transcribed in order to analyse the obtained answers.

- Based on the analysis of the information collected within the focus groups, an opinion questionnaire has been developed targeting the students' preferences regarding the use of mobile devices in the education process. The questionnaire consisted of two parts: the first part looked at the general aspects of the use of mobile devices to online access of the information in an informal environment, and the second part followed the student's preference for mobile classroom learning, in a formal environment. In the final part of the survey, students were asked to express other aspects that they considered important regarding the subject. The data collected based on the questionnaire have been statistically analysed and interpreted in order to highlight students' preferences regarding mobile device integration in the didactic activities.

3 RESULTS AND DISCUSSIONS

The present study was carried out with the help of an opinion questionnaire consisting of 19 items. Some of the answers were collected online, and some were in print. For the applied questionnaire the statistical reliability has been checked (Table 1). The value obtained for the Alpha Cronbach coefficient, \( \alpha = .954 \), indicates a high internal consistency of the work.

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<th>Table 1. – Reliability statistics</th>
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The obtained data have been processed and statistically analysed (average, correlation, factorial analysis), and 17 significant variables have been identified. The orthogonal rotation of the factors has determined the factorial structure. The first factor represents 17% of the variant, and the second factor represents 11% of the variance.

In order to verify the representativeness of the results, the first part of the questionnaire has analysed how much time the participants spent for internet surfing on a daily basis, the type of internet connection and the mobile devices used for this purpose.

The results have shown that of the 135 participants, 46.7% are surfing on the internet for more than 5 hours per day and 31.9% between 3 and 5 hours, mainly using a wi-fi or a mobile connection.

Participants use mobile devices to surf on the internet and the most frequently used ones are mobile phones (68.1% of participants) and laptops (57.8% of the participants). Surprisingly, an insignificant percentage of participants use a tablet, an iPad or a notebook.

There is a significant positive correlation (Pearson correlation coefficient, r = .503) between the use of the mobile connection and the use of the mobile phone for surfing on the internet. Thus, it is appreciated that participants browsing the internet using their mobile phone mainly use a mobile connection (Fig. 1). Participants using a tablet do not use the iPad (r = .503).

![Fig. 1. The dependency relationship between the mobile connection frequency of use and the mobile phone frequency of use](image)

In the second part of the survey, students’ preference was sought for the use of mobile devices in learning, at the classroom. Thus, the below presented results refer to the use of mobile devices in a formal, instructional context.

Most participants prefer to a very large extent to use mobile devices both to access resources and comment upon them (30.4%), as well as to carry out application activities involving the use of applications or software (35.6%). Participants who prefer to access resources and comment on them within the classroom activities have opted for the information presented in the form of images (r = .551) (Fig. 2). Surprisingly, these participants have stated that the viewing of tutorials on a mobile device would help them learn better in class (r = .542). Thus, we can appreciate that students prefer that the information accessed in the classroom through mobile devices be presented in a more structured manner, accompanied by examples through video images and tutorials.
The most preferred formats of presented informations are videos (52.6%) and images (53.3%). Lower percentages of students prefer to a great extent the text format (26.7%) and the audio format (36.3%). There is a positive correlation between students’ preference for accessing information in a video format and information in the form of images (r = .631) or audio (r = .580). Thus, we can estimate that students who prefer to access information in a video format may also prefer audio or image presented information, but the greatest help in learning comes from viewing tutorials (r = .631).

On the other hand, the positive correlation between the preference for image information and the preference to access educational sites (r = .519) and software / applications (r = .512) suggests that students who prefer image presented information are accessing it on educational sites or through online software or applications. However, it is worth noting that although they prefer the information presented in the form of images, these students consider that they are most able to learn from watching video tutorials (r = .628).

The practice activities preferred to a very large extent by the participants are: watching tutorials (55.6%), performing simulations (43.0%), solving problems (38.5%), educational games (38.5%) and exercises (19.3%). The preference for solving exercises on mobile devices is especially associated with educational games (r = 567). For students who prefer solving exercises on mobile phones, performing this type of practical applications would cause them to become more involved in the activities proposed by the teacher (r = .576) and help them identify more easily the learning difficulties within the activities carried out. Students who consider that solving problems would help them to a very large extent in the process of learning find it useful to do certain exercises (r = .567) and perform simulations (r = .538).

With regards to the purpose of using mobile devices in the classroom, participants prefer to a very large extent to use mobile devices for: performing online activities in the classroom (involving an internet connection) (31.9%), developing offline activities in the classroom (not involving an internet connection) (18.5%), solving online tests in the classroom (25.2%), searching / retrieving information needed to achieve classroom tasks (37.0%), transmission of tasks solved in the classroom (40.0%), access to materials made available by the teacher for classroom activity (23.0%), taking notes (24.4%). Participants using mobile devices to perform online classroom activities also prefer to solve online tests in the classroom (r = 612). They also prefer that online activities take place on various educational websites (r = 535) or through educational platforms (r = .507).

Participants using mobile devices to search for / retrieve information necessary to perform classroom tasks, prefer to look for information in scientific databases (r = 523), considering that the
The online media preferred by participants, to a very large extent, to be accessed in the classroom activities are: blogs (11.9%), social media platforms (20.7%), e-mail (34.1%), scientific databases (48.9%), Youtube (41.5%), educational websites (41.5%), e-learning platforms (45.2%), forums (for work group communication) (29.6%), online chat (for work group communication) (37.0%), software / applications from various websites (49.6%). Participants who prefer to access educational platforms also prefer and access the e-mail ($r = .616$) (Fig. 3). They also prefer to use online platforms primarily for passing on solved classroom assignments and accessing materials made available by the teacher. Given the many positive effects (stimulating curiosity, cooperation, increasing the desire to learn) of the virtual learning communities, it would have been interesting to investigate the students' preference for their integration in the educational process, using mobile devices [10].

The high percentage of participants who prefer the use of e-learning platforms (45.2%) is probably due to the fact that the integration of e-learning platforms motivates students [11]. Participants who prefer to access e-mail software also prefer online chat ($r = .519$) and Youtube ($r = .501$). We estimate that these participants prefer to access online media in class from mobile devices mainly for communication / exchange of opinions and viewing tutorials.

![Fig. 3. Correlation between the preference for using educational platforms and preference for accessing blogs, YouTube channel and online chat](image)

The analysis of the results shows that there is a positive correlation between:
- preference for accessing scientific databases and for certain software / applications ($r = .628$) and for using e-learning platforms ($r = .576$).
- preference for using educational platforms and for educational sites ($r = .759$).
- preference for using online chat and for using forums for group communication ($r = .711$).
- preference for classroom use of software / applications and for access the scientific databases ($r = .628$).

In terms of the use of mobile devices in the classroom, according to the form of organization of activity, the participants agree to a very large extent that the use of mobile devices is relevant in the class activities (31.9%), seminars (25.2%) or in the laboratory (38.5%).

Participants who agree upon the relevance of using mobile devices in laboratory activities also prefer to access e-learning platforms ($r = .532$) and educational websites ($r = .515$).

Regarding the option to solve the tasks in a traditional way, a low percentage of the participants prefer this to a very large extent (20.7%), while 38.5% prefer to carry out these activities both traditionally and with the help of mobile devices.

In the participants’ opinion, a better understanding and assimilation of the information transmitted in the class by means of mobile devices would depend to a very large extent on: how to correlate the use of mobile devices with the performed activity (32.6%), the interest expressed by students towards the taught subject (29.6%), the teacher’s teaching skills (36.3%), the teacher’s digital skills (38.5%), students’ digital skills (35.6%), the volume of information transmitted (32.6%).

The student’s interest in the taught discipline depends on the teaching skills of the teacher (the way in which he/she presents the information to them) ($r = .642$) (Fig. 4), which in turn varies proportionally to the teacher’s digital skills ($r = .800$) (Fig. 5).
Students also believe that the digital skills they possess are closely related to the teacher's digital skills \((r = .800)\) (Fig. 6).

From the results on how they are influenced by the performance of classroom practice activities with the help of mobile devices, the participants agree that, to a very large extent: it would determine them to become more involved in the activities proposed by the teacher \((18.5\%)\), it would help them complete / perform their homework / tasks more easily \((34.8\%)\), it would help them learn better \((20.7\%)\), it would help them more focus on the activities \((22.2\%)\), it would make them be more attentive \((23.7\%)\), it would determine them to continue / resume the practice activities in private \((26.7\%)\), they
would be stimulated to research more in private (24.4%), it would cause them not to miss such activities (21.5%), it would help them adapt and perform their activities easier in other contexts / situations (21.5%), it would determine them to interact more with colleagues (14.1%), it would help them identify more easily the learning difficulties during these activities (19.3%), it would help them develop technical skills (34.1%), it would urge them to ask for further explanations from the teacher (25.9%), it would help them achieve better results in evaluations (30.4%).

There is a significant positive correlation between the degree of concentration and the learning efficiency \( r = .760 \), as well as between the degree of concentration and students’ attention \( r = .795 \). Thus, we can appreciate that the use of mobile devices in the development of practice activities makes students pay more attention, which in turn helps them focus and learn more easily.

There is a significant positive correlation between the resumption of practice activities in private and the individual study in private \( r = .725 \). Based on this correlation, it can be estimated that the use of mobile devices in classroom practice activities can cause students to resume these activities in private. In other words, it raises students’ motivation to deepen, in private, the topics addressed in class. These results are also confirmed by literature data supporting an increase in student motivation in learning through the use of such “motivational” strategies of m-learning [6].

Participants who agreed that carrying out practice activities with the help of mobile devices would cause them not to miss such activities, also believe that such activities would motivate them to study more in private \( r = .615 \) and would help them achieve better outcomes in evaluations \( r = .614 \).

Concerning the organization form in performing tasks using mobile devices, 51.9% of the participants prefer to carry out such activities individually, while 48.1% prefer group activity.

The type of tasks preferred by the participants refers to tasks that require being solved in one’s own manner, based on general suggestions (53.3%), but also tasks solved according to a predefined model, with clear indications of solving (46.7% ).

Most participants (83%) agree that the use of mobile devices in the classroom would influence them positively in terms of understanding and assimilation of information. However, participants believe that mobile devices should be used moderately in classroom activities (37% rarely, 28.1% frequently, and 22.2% very frequently). These results are supported by literature data which argue that mobile phone multitasking would affect learning [12].

From the perspective of the m-learning context, participants believe that learning efficiency is greater when using mobile devices in the individual learning process (66.7%) than at class (33.3%). Thus, we can deduce that students have high preference for m-learning in an informal environment.

## 4 CONCLUSIONS

Mobile technology is not an indispensable factor in the educational process. The benefits of m-learning in an educational context depend on the balanced integration of mobile devices within the instructional activities, depending on context, discipline, taught content, etc.

Moreover, in the technical studies from higher education, the integration of mobile technology in didactic activities must be closely correlated with the form of their organization (class, seminar, laboratory), with the specifics of the learning activities and, last but not least, with the specific competencies targeted.

The present study highlights students’ preferences regarding the use of mobile devices in the teaching activities (class / seminar / laboratory) at a technical university.

Based on the obtained results, for the efficiency of the educational process and in particular for the improvement of students learning abilities, in the design of the teaching activities it is recommended to:

- preferably integrate the mobile phone and laptop into the proposed work tasks;
- propose activities that involve accessing resources in scientific databases which students can debate on / analyse;
- use applications and / or software appropriate for learning;
- present information in a more structured way and exemplify mainly with the help of video images and tutorials;
• perform simulations to exemplify real situations;
• use educational sites, e-learning platforms, scientific databases, streaming channels (e.g. Youtube);
• propose learning activities involving the use of appropriate educational games;
• develop online activities (and less offline activities);
• use forums, e-mail, chat for group communication (for group activities);
• transmit a volume of information in accordance with the allocated time;
• integrate mobile devices both in group activities and in individual activities;
• propose tasks that involve both developing an answer according to a predefined model and constructing a free answer.

The present study has highlighted the main benefits that students believe they would obtain from the use of mobile devices in the teaching activities. These refer to the fact that: it could help them with solving work tasks, increase concentration, increase the time spent on the individual study, reduce absenteeism, transfer/apply knowledge acquired in other contexts.

This study has some limitations, meaning that the frequency with which the students surveyed participated in the didactic activities where mobile devices were used is unknown. Participating in such experiences may influence the answers provided by the participants in this study.

Future studies may aim at proposing various scenarios for the integration of mobile devices within the educational process, tailored to the specific disciplines and fields (technical, mechanical, electrical, chemical) and at empirical studies on the effectiveness/benefits of implementing such strategies.

REFERENCES
