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Specific group differences in assessing the usefulness of mobile teaching

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Abstract. Introducing mobile teaching in school represents a challenge for teachers that have to adapt their teaching practice to benefit from the technological changes. Although mobile devices are widely used by teachers and students in everyday life, there are several barriers against the adoption of this technology for teaching purposes. There are also differences in the perception of mobile teaching usefulness that depend on various factors, such as age, gender, discipline, and qualification level. This paper aims to analyze the teachers' perception as regards the benefits of and barriers against mobile teaching, from a domain-specific perspective. The differences are analyzed concerning the discipline they teach, the educational level of the class (form), and the teachers' qualification (didactical degree). The analysis highlights the differences along three dimensions: learning motivation, learning usefulness, and teaching usefulness. Overall, the results show a positive attitude towards mobile teaching and learning.

Keywords: Mobile devices, mobile learning, mobile teaching, group differences.

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1. Introduction

Mobile devices are widely used by teachers and students for a diversity of daily tasks such as communication, interaction, socialization, collaboration, information, and resource sharing. Introducing mobile teaching and learning in schools is challenging teachers to adapt their teaching practice for benefiting from the opportunities given by the technological changes (Thomas et al., 2013; Mc Callum et al., 2014; Lamanauskas et al., 2019).

In the extended technology acceptance model - TAM (Davis et al., 1992), the intention to adopt a given technology is influenced by three main factors:

perceived ease of use, extrinsic motivation, and intrinsic motivation (Ryan & Deci, 2000). In the context of TAM, extrinsic motivation has been conceptualized as *perceived usefulness* and intrinsic motivation has been conceptualized as *perceived enjoyment* (Davis et al., 1992).

Extrinsic motivation should be analyzed from two perspectives: student and teacher. A high expectation of the perceived learning usefulness will motivate teachers to adopt mobile teaching. In turn, they will have a higher perception of the mobile teaching usefulness, since mobile learning is perceived as a way to better stimulate students. Intrinsic motivation is mainly related to students who are less motivated to learn disciplines that are not interesting for them. In this respect, mobile teaching could better explain difficult concepts and increase students' motivation to learn (Lamanauskas et al., 2019).

Despite the familiarity with mobile devices, several barriers exist against the adoption of this technology for teaching and learning (Ertmer, 1999; Tsai & Cai, 2012; Leem & Sung, 2019; Pribeanu et al., 2020). Mobile teaching is a difficult task, needing adequate infrastructure in schools, basic and advanced digital skills (Mc Callum et al., 2014; Lamanauskas et al., 2019), and an additional effort from the teachers who have to plan and prepare the lessons (Thomas et al., 2013; Pribeanu et al., 2020).

The objective of this paper is to analyze the perceptions of Romanian teachers as regards the barriers against and the benefits of mobile teaching and learning. The goal of the analysis is to reveal differences from three different points of view: the discipline they teach, the educational level of the class (form), and the teachers' qualification (their didactical degree).

The rest of the paper is organized as follows. In section 2, some related work is discussed. The method and sample are presented in section 3. Then, the group differences by discipline, form, and qualification are analyzed and discussed. The paper ends with a conclusion part in section 5.

2. Related work

Several recent studies investigated how mobile technology can be implemented in the teaching-learning process of different educational disciplines: in Mathematics and Science (Soboleva et al., 2020; Juskaite, Ipatovs & Kapenieks, 2019; Bano et al., 2018; Crompton et al., 2016), in History (Price, Jewitt & Sakr, 2016; Aying, Awang & Ahmad, 2019), in

Geography (Kingston et al., 2012), in Art (Katz-Buonincontro & Foster, 2013).

The meta-analysis study conducted by Talan (2020) highlights the fact that mobile technology leads to increase the student's involvement in learning, motivation for getting knowledge, performance in various educational fields, but also to facilitate student-centered learning, provide independence of time and space in learning management, respond to individual knowledge needs and own pace of learning, support collaborative and life-long-learning, facilitate distance learning or constitute support for traditional learning. At the same time, it plays an important role for teachers, through the offered opportunities (Talan, 2020, p. 81).

The analyzed studies show that academic performance (achieved through mobile means) depends on several important conditions, such as (Talan, 2020, p. 90): how mobile learning is implemented; type and quality of mobile devices; teacher's ability/competencies to plan, organize, manage and implement the didactic demarche; motivation and attitude towards the course. In addition, the curriculum should be reviewed to integrate mobile learning to support and increase formal education.

Other investigations are oriented on finding the correlations between different teacher variables (age, gender, work environment, anxiety, personality factors, individual perceptions) and mobile teaching ones, as well as the benefits or difficulties encountered in this process. On the other hand, there have not been encountered studies that relate to the discipline they teach, educational level of the class (form), and teachers' qualification (didactical degree) when using mobile technology in teaching.

3. Method and sample

This work is part of the second step of a larger study aiming to understand the factors that influence the adoption and use of mobile devices in schools. Based on the findings of a preliminary qualitative study (Lamanauskas et al., 2019; Pribeanu et al., 2020), an evaluation instrument has been developed and administrated to teachers from Lithuania and Romania, during a pilot study, in November-December 2019.

The Romanian sample consists of 125 teachers (34 men / 91 women), involved in the teaching of the following disciplines: Chemistry (21), Physics (20), Geography (20), Science (28), and Technology (36, including ICT). 22

teachers have the basic didactic degree, 22 have the second didactic degree, and 81 the first (highest) degree. 70 teachers are involved in lower secondary education - respectively 22 are teaching at 5th - 6th forms, 48 at the 7th - 8th forms. The rest of the 55 are high-school teachers, teaching at 9th - 10th forms (34) and 11th - 12th forms (21).

Teachers were asked to answer general questions related to age, gender, qualification, and curricula, then to rate several statements on a 5-points Likert scale. Finally, they have been asked two open-ended questions related to technical conditions and barriers. The variables, including *mean values* (*M*) and *standard deviation* (*SD*), are presented in Table 1.

Table 1. Variables (N=125)

Variable	M	SD
Motivation to learn		
By using mobile technology students may be *less bored* by the traditional methods	4.05	1.02
By using mobile technology students may find the lesson more *attractive*	4.25	0.89
By using mobile technology students are less stressed, and learning is accepted *as a game*	4.02	0.97
By using mobile technology students may find the lesson more *interesting*	4.34	0.86
Learning usefulness		
Mobile technology may help to learn *outside the class*	4.10	0.90
Mobile technology may help the *collaborative* learning	4.08	0.83
Mobile learning stimulates *creativity*	3.84	0.95
Mobile technology may help to better *understand* the lesson	4.08	0.79
Teaching usefulness		
With mobile technology, I could *prepare* more interesting lessons	4.26	0.80
Mobile technology helps to give learning *tasks* to students	4.06	0.79
With mobile technology, I could better *explain* difficult concepts	3.78	0.94
With mobile technology, I could better *stimulate* the students to learn	3.97	0.83

Overall, the mean values are above 3 (neutral value) showing a positive attitude towards mobile teaching and learning. The differences by qualification, discipline, and educational level have been analyzed by the mean comparison and one-way ANOVA test for significance.

4. Results

4.1 Differences by didactic degree

The differences by didactic degree as regards the learning motivation, learning usefulness, and teaching usefulness are presented in Figure 1 (basic = 22 teachers, 2nd-degree = 22 teachers, 1st-degree = 81 teachers).

The perception of students' motivation expectancy is influenced by how teachers manage to build an interesting and attractive teaching approach; the obtained results indicate that the teaching degree is not a variable on which the motivation for learning depends - no statistically significant differences have been found between those three groups of teachers.

Concerning the learning usefulness, the obtained results do not indicate significant differences between the categories of teachers. More, considering the teaching degree, the surveyed teachers built learning experiences outside the classroom, through collaborative and creative learning, that facilitate the understanding of the taught contents.

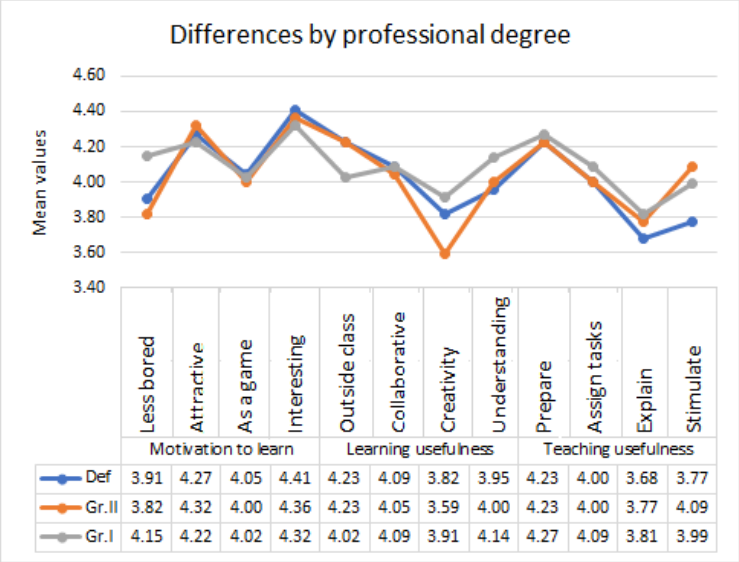

Figure 1. Qualification-related differences

Referring to the perception of the surveyed teachers, the didactic degree does not influence the teaching usefulness - the resulted figures do not

indicate a clear correlation between the didactic degree and the psycho-pedagogical competencies of the teachers (preparing lessons, giving learning tasks to students, explaining difficult concepts, stimulating students to learn).

Table 2. Main barriers mentioned by survey teachers

	equipment	Internet	misuse	abilities	digital skills	lack of funds
Def	17	13	2	2	3	0
Gr.II	15	8	0	3	8	1
Gr.I	64	28	6	22	10	6
Total	96	49	8	27	21	7

As regards the barriers against the adoption of mobile technology for teaching, as shown in Table 2, the most frequently mentioned by the teachers - from those three categories (basic degree, 2nd-degree, 1st-degree) - were concentrated on equipment and the Internet, with the highest figures in the case of 1st-degree teachers. Also, the 1st-degree teachers mentioned that lack of abilities and digital skills are other barriers when introducing mobile technology in the didactic process.

The respondents were asked about the equipment used in their teaching activity: laptops (Lap), tablets (Tab), mobile phones (Mob), smartphones (SmP), smart bracelets (SmB), training methods - generally based on ICT (CBT), digital textbooks, exercises and tests (DTexB), Wi-Fi connected devices (WiFi), social networks (SN), educational blogs (EduB). In this respect, Table 3 illustrates their feedback.

Teachers who have the basic didactic degree use laptops with WiFi more often in teaching. The 2nd-degree teachers frequently use mobile phones with WiFi connections, but in the same situation are also the 1st-degree teachers.

Smart bracelets (SmB) and tablets (Tab) are the least used means by the surveyed teachers.

Table 3. Equipment used by surveyed teachers

	Lap	Tab	Mob	SmP	SmB	CBT	DTexB	WiFi	SN	EduB
Def	3.14	1.09	2.64	1.73	0.45	1.41	2.09	2.73	1.59	2.55
Gr.II	2.36	1.05	3.41	2.36	0.09	1.27	2.00	3.18	2.32	2.41
Gr.I	2.35	1.10	2.69	2.31	0.40	1.20	1.62	2.53	2.17	2.09

4.2 Differences by discipline

The differences by the discipline are illustrated in Figure 2.

The perception of respondents is oriented on the fact that mobile technology contributes to the students increasing motivation to learn, (especially at Chemistry, Geography, and Sciences), having more learning usefulness (in special at Chemistry and Physics), and also, increasing teaching usefulness (especially at Chemistry and Sciences).

A one-way ANOVA (4, 120, 124) shows that the differences are statistically significant for collaborative learning (F=2.626, p=0.038) and for preparing more interesting lessons (F=2.549, p=0.043). Marginally significant differences have been found for learning accepted as a game (F=2.154, p=0.078), more interesting lessons (F=2.334, p=0.060), and better understanding (2.052, p=0.091).

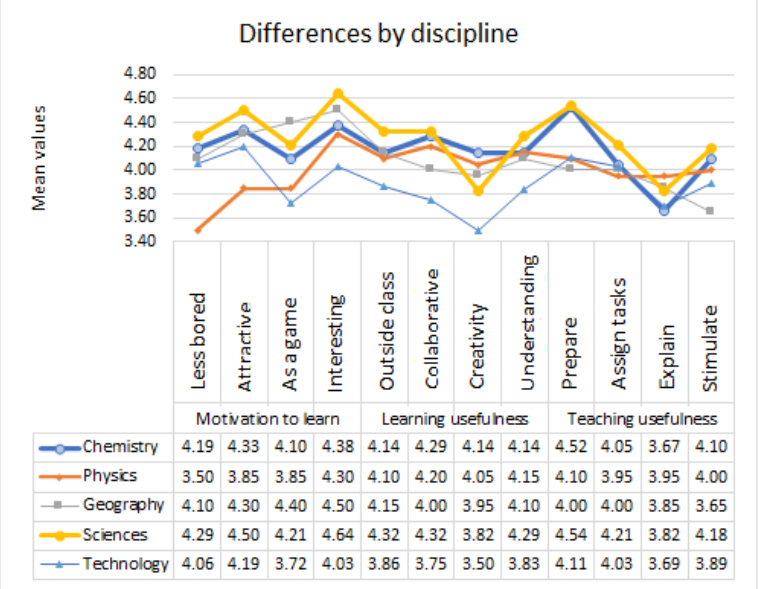

Figure 2. Discipline-related differences

As regards the barriers against the adoption of mobile technology for teaching, as shown in Table 4, the most frequently mentioned were lack of equipment and Internet - the highest values being recorded in the case of

teachers who teach Technology (including ICT). The lack of equipment is practically the main difficulty mentioned by the surveyed teachers, in all analyzed disciplines.

Table 4. Main barriers mentioned by surveyed teachers

	equipment	Internet	misuse	abilities	dig skills	lack of funds
Chem	16	8	4	6	0	0
Phys	12	7	3	7	0	0
Geogr	18	13	0	4	3	0
Science	21	9	1	7	3	6
Tech	29	12	0	3	15	1
Total	96	49	8	27	21	7

The frequency of using the mobile technology in teaching activities has resulted as follows: the most used virtual means are represented by laptops (Lap), tablets (Tab), and SmartPhones (SmP) - this trend is similar in the case of all taught disciplines by the surveyed teachers; the least used in teaching are social networks and educational blogs.

Table 5. Equipment used by surveyed teachers

	Lap	Tab	Mob	SmP	SmB	CBT	DTexB	WiFi	SN	EduB
Chem	2.90	2.43	1.62	3.00	2.05	2.95	1.67	2.10	0.86	0.81
Phys	2.70	3.00	2.10	2.65	2.00	2.25	1.15	1.35	1.35	0.40
Geogr	2.35	2.70	2.40	2.05	1.65	1.90	0.75	2.05	1.00	0.05
Science	2.36	2.64	2.39	2.57	2.00	2.11	1.57	1.68	1.21	0.57
Tech	2.31	3.11	2.39	2.94	2.50	2.06	1.08	1.72	1.03	0.06

4.3 Differences by forms (curricula)

The differences by educational level (forms) are illustrated in Figure 3.

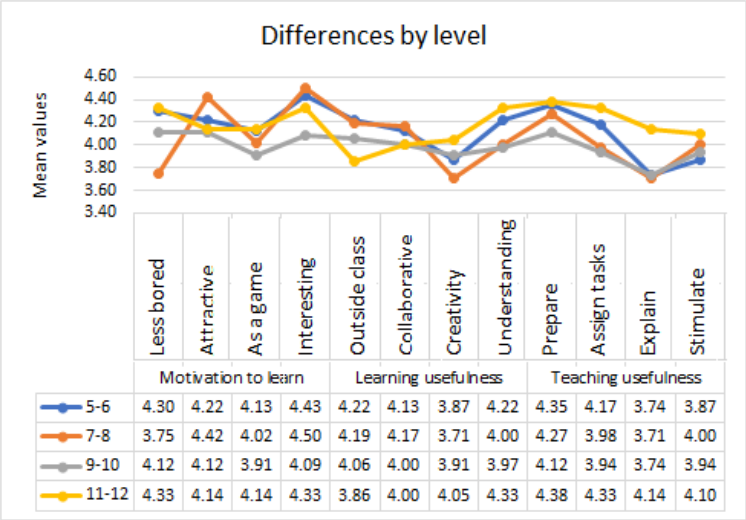

Figure 3. Differences by educational level (forms)

Summarizing the data according to the criterion of *educational level (forms)*, the obtained results illustrate that mobile technology contributes to the development of motivation to learn, increases learning usefulness and teaching usefulness to a greater extent for the 5th and 6th grades students, but also the 11th and 12th grades students.

A one-way ANOVA (3, 121, 124) shows only one marginally significant difference for the expectancy of less bored students (F=2.231, p=0.088).

As regards the barriers against the adoption of mobile technology for teaching, the most frequently mentioned was lack of equipment and Internet connection, in special at 7th and 8th classes. There are similarities also in other educational levels (forms).

Table 6. Main barriers mentioned by surveyed teachers

	equipment	Internet	misuse	abilities	digital skills	lack of funds
5-6	18	14	2	2	3	0
7-8	35	15	5	20	0	1
9-10	29	12	1	2	10	5
11-12	14	8	0	3	8	1
Total	96	49	8	27	21	7

The frequency of use of mobile technology in teaching activities finds laptops and mobile phones with Wifi connection as the most used virtual means, this trend being similar in the case of all classes; the least used in teaching are smart bracelets.

Table 7. Equipment used by surveyed teachers

	Lap	Tab	Mob	SmP	SmB	CBT	DTexB	WiFi	SN	EduB
5-6	3.04	1.04	2.70	1.83	0.43	1.35	2.00	2.61	1.70	2.52
7-8	2.40	1.31	2.77	2.42	0.67	1.29	1.83	2.75	2.17	2.42
9-10	2.21	0.76	2.62	2.21	0.00	1.09	1.29	2.32	2.15	1.59
11-12	2.48	1.10	3.38	2.29	0.10	1.29	2.05	3.14	2.38	2.43

4.4 Discussion

The results of the study show that didactic degree does not represent a variable directly correlated with the use of mobile technology in the teaching-learning activities - no statistically significant differences have been found between the three groups of teachers that have been analyzed. The surveyed teachers use mobile technology - within the limits of their resources - in activities with their students.

As regards the expectations about introducing mobile technology in the teaching and learning process, teachers have a positive attitude. They seem to be very confident in the increased motivation to learn but less confident that that mobile learning will stimulate creativity.

As regards the barriers against the adoption of mobile technology for teaching, the most frequently mentioned by the teachers referred to equipment and the Internet, with the highest figures in the case of 1st-degree teachers. Also, the 1st-degree teachers mentioned that abilities and digital skills represent barriers to introduce mobile technology in the didactic process.

The differences are not depending clearly on the taught discipline - mobile technology is used in Chemistry and Sciences, to prepare more interesting lessons, for collaborative learning, with the view to raise students' understanding. The lack of equipment is the main difficulty mentioned by the surveyed teachers, in the case of all disciplines. Overall, the results are confirming the findings of previous studies (Pribeanu et al., 2020; Santi et al., 2020).

The most used means concerning mobile technology in teaching activities

is represented by laptops, tablets, and SmartPhones, with WiFi connection. The least used for educational purposes are social networks, smart bracelets, and educational blogs.

There are several limitations of this exploratory study. First, the sample of the research is not very extensive (125 subjects), so that the results cannot be generalized at the national level. Secondly, the distribution by teachers' qualification (didactic degree) and the educational level (form) is not balanced. Also, not all studied disciplines (as provided by the national curriculum) were represented.

An inherent limitation is given on the fact that only the teachers' perceptions have been collected and analyzed. Their expectations as regards the learning usefulness and motivation are subjective and may considerably differ from students' perceptions.

5. Conclusion and future work

This study contributes to a better understanding of how Romanian teachers are perceiving the barriers and benefits of introducing mobile teaching in schools. The results show that teachers understand the importance of mobile technology in achieving a qualitative education and capitalizing on the opportunities created by the existence of mobile devices. But, unfortunately, they do not benefit from a proper infrastructure and sufficient resources, as they need.

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