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Secondary education teachers' perceptions of mobile phone and tablet use in classrooms: benefits, constraints and concerns

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Abstract The use of mobile devices in secondary education schools is an emerging issue; however, empirical evidence regarding secondary education teachers' perceptions on mobile technology and mobile learning is still limited. This study investigated Greek secondary school teachers' perceptions of mobile phone and tablet use in classrooms, focusing on their perceived benefits, constraints and their concerns. A questionnaire with open-ended questions was administered to 64 teachers of different specializations. The primary perceived benefits were associated with students' involvement/motivation and active participation, the interactive-enjoyable lesson, the easy access to information and students' familiarity with technology. Teachers' perceived barriers were mainly related to the lack of equipment and the current legislation (regarding mobile technology usage in school settings). Key concerns regarded students' abusive behavior and the difficulty in controlling them, the noise-disruption in class and students' distraction. Implications and recommendations for teachers, students, school policy and educational policy makers are discussed.

Keywords Mobile technology · Mobile phones tablets · Teacher perceptions · Secondary school · Greece

Introduction

Mobile technologies continue to expand and evolve with tablets and smartphones (Whyley 2018) and mobile devices have become a learning tool with great potential in both classrooms and outdoor learning (Fu and Hwang 2018; Chang

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and Hwang 2019). Researchers have called the learning mode that employs mobile technology/devices to facilitate or support learning, mobile learning (m-learning). Mobile learning is a recent technology that has been developed rapidly to deliver e-learning using personal mobile devices without posing any restrictions on time and location (UNESCO 2012); mobile learning has become an umbrella term for the integration of mobile computing devices within teaching and learning (Grant 2019). For the purpose of this paper, mobile learning can be defined as facilitating and enhancing the learning process via mobile devices anytime and anywhere, while the use of mobile devices in education (known as m-learning) is considered in terms of its potential pedagogical benefits such as enhancement of student motivation, achievement and communication (Baydas and Yilmaz 2018). M-learning has many benefits: continuous, ongoing, flexible learning; it enables time for reflection; it facilitates informal and formal learning; it supports personalization; it is readily available; ubiquitous; contextual and relevant; it provides ubiquitous access and supports user-generated media (Zhang 2015; Sullivan et al. 2019). The educational affordances of mobile devices (communication features, access to information etc.) have the potential to support school pedagogical practices (Crompton et al. 2017). In parallel, challenges have been reported with regard to mobile technology usage in schools. For example, smart/mobile phones have been seen more as distracters in the classroom rather than learning aids (Anshari et al. 2017), several countries have banned/restricted their usage at school premises and some teachers have conceived them as disruptive to the learning process (Ashfaq and Mirza 2018).

Evidence reported on the high penetration rate of mobile devices and their widespread popularity among the teenagers (Chee et al. 2017; Wishart 2018), the predominance of the smart/mobile phone amongst secondary school students (Moore and Vitale 2018; Nikolopoulou 2018), and in some cases daily use of technological devices for school-related activities (Moore and Vitale 2018). The rapid development of mobile technologies together with secondary school students' increased ownership of mobile devices with internet access, have the potential to expand communication methods, collaborative learning, access to traditional learning and access to information resources (Fu and Hwang 2018). The use of mobile devices among secondary school students and teachers is increasingly more common (Christensen and Knezek 2018), while mobile learning and mobile technology perceptions research in secondary education is still limited (Hwang et al. 2018). The purpose of this study was to investigate Greek secondary school teachers' perceived benefits, barriers/constraints, and their concerns regarding mobile phone and tablet use in classrooms. Investigating teachers' perceptions is important, because teachers' views towards the value of technology to aid students' learning have a strong effect on actual technology use in the classroom (Khlaif 2017). The success of integrating technology in the classroom requires positive perceptions and attitudes toward that technology and some awareness about its benefits (Al-Jarrah et al. 2019). Before the literature review section, a brief presentation of the context of mobile learning in Greece is briefly described here (it is presented in more detail in Nikolopoulou 2020).

In Greece, the official legislative framework (June 2018), from the Ministry of Education (it is a centrally supported school system), states that within the school environment, primary and secondary school students may not own mobile phones or any other electronic device/game that has a system of processing image and sound. Although, mobile phone use is officially banned, during the school intervals (despite the ban), several students *switch on* their mobile phones in order to take photos/videos, send messages or enter social networking sites, while within semi-formal settings (such as school projects, clubs, extra-curricular activities and field trips) students are allowed/encouraged to use their mobile devices. The use of mobile devices/technology in Greek schools is negatively affected by the current legislative framework. The official curriculum of different subjects for secondary education (ages 12–18) makes reference to ICT, but there is no reference to mobile technology/devices or mobile learning. Within this context, a few teachers make their own decisions, take initiatives and allow their students to use mobile devices/phones in classroom, for educational purposes. Within the Greek context there is insufficient empirical evidence regarding secondary school teachers' perceptions on mobile technologies/learning.

Literature review

Prior studies (e.g., Lenhart et al. 2010; Thomas et al. 2014; Ozdamli and Uzunboylu 2015; Christensen and Knezek 2018) reported on teachers' perceptions towards mobile learning and mobile technology/devices' usage in class. In some studies (e.g., Thomas et al. 2014; Dinsmore 2019) secondary school teachers supported mobile technology use in the class due to the teaching advantages/benefits it offers and its power to mobilize pupils' interest (Taleb et al. 2015; Christensen and Knezek 2018; Kusloglou and Syrpi 2018), while in other studies (e.g., Lenhart et al. 2010; Olufadi 2015; Christensen and Knezek 2018) teachers viewed mobile devices as a distraction for the classroom. However, despite the significant growth and capabilities of mobile technology, there is still limited empirical evidence regarding secondary school educational settings (in comparison to other levels of education such as University education).

In the USA, Thomas et al. (2013) surveyed 79 teachers to determine their perceptions of using cell phones for classroom instruction. Findings indicated that the majority of teachers (69%) support the use of cell phones in the classroom and were using them for school-related work. Teachers identified student engagement and motivation as the primary benefits, while constraints/barriers/limitations included lack of access and class disruption. In the same country, Black-Fuller et al. (2016) in a survey of secondary school teachers indicated the positive attitude of teachers towards mobile learning as well as the barriers to its use in the classroom (low level of comfort with the use of mobile devices, lack of relevant training). Among the benefits reported by educators, again in the USA (Christensen and Knezek 2018), were students' engagement, student participation in classroom discussions, and improvement of communication between students and teachers; educators who were higher in technology integration reported the greatest benefits

from mobile learning. At the same time there are views indicating that technology can be counterproductive. Wexler (2019), in the USA, reported that college students and eighth graders who used digital devices in their classes did worse on exams, while in some counties where they started abandoning textbooks and paper—with the goal of attaining 1:1 ratio of mobile devices-test scores became worse; this evidence makes teachers (and parents) skeptical towards the move to the screens.

In the United Kingdom, Whyley (2018) reported on school leaders' perceptions of barriers, and E-safety was regarded as a major barrier; the security of the data, information, images, and video contained on students' mobile devices, in the Bring Your Own Device policy. Also, the development of appropriate mobile learning pedagogy was an issue, as the focus did not begin with the pedagogy but with what the device can do. In Portugal, Lucas (2018) reported on external barriers identified during implementation of an innovative 1:1 tablet initiative in lower secondary schools. Among the barriers identified (by students and their teachers) were ICT infrastructure, hardware, software, physical learning spaces, curriculum, provision of professional development, training programs, time, timetabling and technical support. Concerns expressed by educators (Olufadi 2015) were distraction concerns with regard to the possibilities of multiple tasking to distract not only students' own attention to learning, but also their peers' and educators' attention in the class.

In Belgium, Montrieux et al. (2014) found that secondary school teachers' acceptance of tablet devices were, in general, positive. Teachers were intrinsically motivated, while their acceptance seemed related to attaining a positive attitude, social influence and the sense to master the new mobile technology. Montrieux et al. (2015) showed that the use of tablets in the classroom setting had an impact on both teaching and learning practices (the introduction of tablets entails a shift in the way students learn, as the devices provide interactive, media-rich, and exciting new environments). The barriers identified by the teachers regarded the lack of relevant software, non-reliable internet connection, limited teacher training opportunities and lack of time for training.

Msuya (2015) examined how secondary school teachers use their mobile phones in teaching and learning, in Tanzania. The study found that most of the teachers had little knowledge on the use of mobile phones as a tool for ICT pedagogical uses; they were not using their smartphones for educational purposes.

Ozdamli and Uzunboylu (2015) reported positive perceptions towards mobile learning among secondary school teachers (and students) in Northern Cyprus; teachers wanted to use m-learning in education, but their adequacy levels were not sufficient. Teachers were better users of devices that they use in their daily routines such as mobile phones, while they wanted to make use of m-learning applications with the aim of supporting their lessons in the classroom.

In Korea, Leem and Sung (2019) investigated primary and secondary school teachers' technology acceptance of smart mobile devices in their lessons. Their results indicated that teachers' beliefs consistently revealed the factors of immediacy, interest, interactivity, instability and inconvenience; teachers' beliefs could be a major barrier to the use of technology in the classroom. Also, Kim and Kim (2017) explored the perceptions of teachers in Korean rural schools regarding teaching and learning, including technology preparedness, performance, difficulties,

and continuing integration in tablet-based interactive classrooms; teachers reported that their continuing integration of lessons with tablets was correlated with their beliefs about the applicability of tablets for lessons, their personal interests, as well as students' satisfaction with previous lessons and expectations.

Khlaif (2017) investigated middle school teachers' attitudes towards the adoption and acceptance of tablets into their teaching, and the factors affecting these attitudes. It was found that most teachers reported positive attitudes, and that they used tablets because it facilitates their teaching and provides equality of access to the internet and educational technology for students in rural schools.

In parallel, some studies indicated the impact of factors/variables on teachers' mobile technology/learning perceptions; it was indicated that different factors such as age (O'Bannon and Thomas 2014), years of teaching experience (Baek et al. 2017), teacher training in ICT (Msuya 2015; Kousloglou and Syrpi 2018) and specialization affect teachers' perceptions. For example, O'Bannon and Thomas (2014), in the USA, indicated that age impacts on teachers' perceptions on using mobile phones; those over 50 years old differed significantly in mobile phone ownership and support for mobile phone usage in the classroom, as well as in their perceptions regarding the useful mobile features for school-related work (i.e., the older teachers were less likely to own smartphones, were less enthusiastic about the features, and found the barriers to be more problematic). Baek et al. (2017) investigated Korean teachers' attitudes toward mobile devices and whether they differ in terms of teachers' gender, school level, teaching experience and specialization; it was found that female teachers, those with more than 15 years of teaching experience, as well as secondary school teachers had more positive attitudes.

Regarding the Greek context, the ITU report (2018) ranked Greece among a higher scoring European nation in the Information and Communication Technologies Development Index (IDI); between 2014 and 2016, fixed-broadband mobile penetration increased by four percentage points in Greece. However, there are very few studies regarding Greek teachers' (or students') perceptions. For example, Kousloglou and Syrpi (2018) investigated 318 secondary school teachers' perceptions on the use of mobile phones for educational purposes; around 38% of the sample said they often use mobile phones/tablets for educational purposes, while 75% of respondents expressed willingness to integrate mobile devices in the learning process (they said, it is likely to increase students' interest/motivation), if the law allows it. Another recent study (Nikolopoulou et al. under review) with a sample of 920 primary and secondary school teachers (secondary school teachers constituted 60% of the sample) indicated that, in general, they expressed positive perceptions on mobile learning readiness. The highest percentage of agreement regarded the possibilities of mobile learning (over 60%). Teachers who use mobile devices in class reported significantly more positive perceptions. ICT training and attendance of ICT conferences, both affected positively teachers' perceptions on mobile learning benefits and preferences. Also a recent study with pre-service kindergarten teachers, indicated that teachers' attitude toward the usefulness of mobile learning in the teaching process has the strongest influence on their intention to adopt mobile learning followed by perceived ease of use (Kalogiannakis and Papadakis 2019). Since the topic of mobile learning/technology is not covered in the literature in the

Greek context, the findings of this study are expected to have implications for the broader school community or stakeholders (policy makers, teacher trainers, and teachers).

Research questions of the study

The following research questions were addressed:

(a) What are teachers' perceptions of the benefits of using tablets and mobile phones in the classroom?
(b) What are teachers' perceptions of constraints/barriers and their concerns associated with tablets and mobile phone usage in the classroom?

It is noted that the focus is on mobile phones and tablets (not laptops) because (i) some researchers exclude laptops from mobile technology definitions and, (ii) these devices are banned from Greek classrooms and there is limited research on this issue. This study was carried out as part of a larger research project regarding mobile technology supported learning in Greek educational settings (the author of this paper is the scientific coordinator of the project) and official permission was obtained from the Greek Ministry of Education and the University's ethics committee.

Method

Sample and procedure

This study was carried out in four state secondary schools, two in N. Greece and two in the capital, all of similar socio-economic status. The research was qualitative and ethical issues/guidelines were considered; ethics are important in qualitative research (Creswell 2012). Initially, a greater number of schools were contacted and were informed about the voluntary participation in the survey; the schools were chosen on the basis of similar socio-economic status and the accessible location to the author-researcher. The researcher initially asked for school principals' consent about the participation of teachers in the study, according to the new General Data Protection Regulation (GDPR). The school principals (head-teachers) of the four schools indicated willingness to participate in the study, while other principals denied. All participants were informed about the research aims of the study and they were assured that, should they wish to participate in the research, their comments and input would remain anonymous; the data gathered will be used solely for research purposes. Table 1 shows the participants' characteristics: gender, years of teaching experience, specialization, years of ICT use in class for educational purposes, years of using a mobile device with internet access (for personal use), teacher training in ICT, use of mobile devices (tablet or mobile phone) in the classroom. Of the 64

teachers, 44 were women and 20 were men. Regarding teacher specialization, 16 were teachers of Greek language and literature, 10 science teachers, 8 mathematics teachers, 8 foreign language teachers and the rest from other specializations. As shown in Table 1, the majority of the teachers own and use a digital mobile device with internet access for personal use. The majority of the sample (68%) reported they use ICT in the class for educational purposes, while only 1/5 of the sample (15 out of 64 teachers) stated they use tablets and/or mobile phones in class for educational purposes.

It is noted that all participant schools have a computer lab, a science lab with a computer and a projector, and there is the necessary infrastructure so that any teacher who wishes can carry his/her own laptop in the classroom. In addition, the schools have interactive whiteboards in most classrooms, while one of them has also a specially designed classroom with multimedia.

Research instrument

The data were collected via a questionnaire in September 2019; they were collected to provide the background context to the larger study/project mentioned earlier. As ethical guidelines were followed, the teachers completed the questionnaires in a quiet location within the school setting, during a time period that their teaching duties were not disturbed. The questionnaire was designed by the author for the purpose of this study and included open-ended questions (open-ended responses to a questionnaire are qualitative documents); such practices are in line with qualitative research (Creswell 2012). The questionnaires were distributed and collected by the

Table 1 Sample characteristics (64 teachers)

Gender	Years of teaching experience
Female: 44	11–20: 29
Male: 20	20+: 35
Specialization	Years of using a mobile device with internet access (for personal use)
Greek language-literature: 16	10+ years: 33
Science: 10	6–10 years: 25
Mathematics: 8	1–5 years: 4
Foreign languages: 8	Never: 2
Information technology: 6	Mobile devices' (tablet, mobile phone) usage in class for educational purposes
Social studies: 4	Yes: 14
Home economics: 4	No: 50
Religion: 3	
Arts: 3	
Technology: 2	
Years of ICT use in class for educational purposes	Teacher training in ICT
10+ years: 19	A' level (technical training): 26
5–10 years: 12	B' level (pedagogical training): 24
1–4 years: 13	No training: 14
Never: 20	

author in case any clarifications were needed. The general axes were related to the objectives of this study.

For those teachers who use tablets and/or mobile phones in the classroom, the questions were: Why do you use them? What are their advantages? How often and how do you use them? What are the students' feelings when they use these mobile devices in the classroom? What are your concerns? Which are the barriers/obstacles regarding mobile devices' (tablets or mobile phones) usage in the classroom?

For those teachers who do not use tablets and/or mobile phones in the classroom, the questions were: Why are these mobile devices not used in the classroom? What are the barriers/obstacles and your concerns? In your opinion, are there any advantages/benefits of mobile devices' usage in the classroom? Under what conditions would you use tablets and/or mobile phones in the classroom?

With regard to content/thematic analysis, the codes for the data analysis were descriptive. Through the process of coding, patterns of responses were used to inform themes and categories generated in line with their relevance to the research questions (Creswell 2012). Teachers' responses were thematically grouped into those which (predominantly) related to benefits, barriers and concerns. The completion of self-reported questionnaires poses methodological challenges; for this matter, anonymity was confirmed so as to eliminate possible untruthful responses. Next section ("Results") presents the perceptions/views of those teachers who use and do not use mobile devices in the classroom (the key themes of benefits, barriers and concerns are described under each subsection), while the overall discussion on perceived benefits, barriers and concerns follows afterwards. It is noted that the focus of this study was not to compare the views of the two groups of teachers (users, no-users).

Results

Perceptions of teachers who use mobile devices in the classroom

Table 2 shows the perceptions/views of teachers who use tablets and/or mobile phones in the classroom (in brackets appears the number of references). The primary purposes/reasons for mobile devices' usage and the advantages/benefits reported by the participants were: the attractive/enjoyable/interactive environment (8 references), students' motivation/participation/engagement (7 references) and the support of lessons/teaching via mobile technology (6 references). Other benefits included students' familiarity with the technology, easy access to learning resources and easy presentation of educational material. It was indicated that the mobile devices (tablets or mobile phones) are mainly used in groups with worksheets and as supportive/complementary tools to the lesson. The primary barriers perceived by these teachers were the legislation on mobile phone/tablet use and the availability of resources/equipment, while their main concerns were related to potential abusive students' behavior and class disorder (half of the users did not express any concern).

Table 2 Perceptions of teachers who use mobile devices in the classroom ($n = 14$)

Purposes/reasons for mobile devices' usage in class—Benefits	Attractive/enjoyable/interactive environment/lesson (8) Students' motivation/participation/engagement (7) The lesson/teaching is supported via mobile technology (6) Students are familiar with the technology (5) Easy access to learning resources (2) Easy presentation of educational material (2) Many affordances of mobile phones (2) Use of devices as measuring/laboratory instruments (1)
Frequency of use	Daily (3) 2–4 times per week (4) Once per week (5) Once per month or less (2)
Way of devices' usage	Mainly in groups—with worksheets (7) As support/complementary to the lesson (5) As a whole-class, in conjunction with a data projector (3) As measuring instruments (2)
Students' feelings	Interest, excitement/joy, contentment (12) Curiosity (2)
Barriers	Legislation regarding mobile phone or tablet use (8) Availability of equipment/resources (6) Weak internet/ Wi-Fi signal (3) Inadequate/unsuitable space (2) Difficulty for students to work in groups (2) Different operating systems in students' mobile phones (1) The cost of devices in case they are lost (1)
Concerns	Potential abusive behavior of students, class disorder (6) Student distraction (2) Mobile devices' usage requires a lot of time (2) The devices need to remain in school (1)

Some excerpts from teachers' answers are presented below (the teacher's specialization is in brackets). Regarding their perceived advantages/benefits, a teacher said "the lesson becomes more enjoyable, interactive, group oriented, breaks the monotony" (Science teacher). Regarding students' emotions, teachers expressed the view that students liked using mobile devices, for example, "enthusiasm, participation of ALL students, contentment from their performance -mainly by students with learning disabilities" (Science teacher), and "generally positive (feelings), students show interest, as long as it (mobile technology) is not perceived as a game" (IT teacher).

With regard to teachers' perceived barriers, "when there is limited number of devices at school and those who are interested have to share them" (foreign languages teacher), and "Wi-Fi connection…students' mobile phones have different operating systems (ios, android)" (IT teacher). An example of a concern was "children become addicted to the image and their relationship with the book is threatened" (Greek literature teacher).

Perceptions of teachers who do not use mobile devices in the classroom

Table 3 shows the perceptions/views of teachers who do not use tablets and/or mobile phones in the classroom (in brackets appears the number of references). Regarding the reasons for not using these mobile devices, several teachers (18 out of 50) reported they do not use them because they use either a laptop or an interactive whiteboard or a desktop computer. Perceived barriers included lack of or limited resources/equipment (15 references), lack of teachers' confidence/knowledge/skills (10 references), inappropriateness of devices for their specialization/lesson (8 references) and prohibitive legislation (8 references). Teachers' perceived concerns were associated with the difficulty in controlling the students (e.g., students' abuse of tablet/phone use, students' surfing on other than those indicated by the teachers-Web

Table 3 Perceptions of teachers who do not use mobile devices in the classroom (n = 50)

Reasons for not using mobile devices in classroom—barriers	I use a laptop/ interactive whiteboard/ desktop computer (18) Lack of or limited resources/equipment (15) Lack of teachers' confidence/knowledge/skills (10) Inappropriateness of mobile devices to my specialty/lesson (8) Prohibitive legislation/tablets and mobile phones are banned (8) Lack of student readiness (4) Lack of students' familiarity with programs/apps (2) Inadequate teacher training (2)
Concerns	Difficulty in controlling the students, abuse of tablet/phone by students, students surf on other WebPages (21) Noise in class (13) The students are distracted (11) Students' addiction to the image (3)
Advantages—benefits	Active involvement/ interest/motivation of students (16) Interactive/enjoyable lesson (12) Easy access and display of information (9) There are advantages to other specialties/courses (not to my own) (6) Students are familiar with the technology/they enjoy using mobile phones (6) Useful devices for exercises/ individual work (6) Provision of visual experiences (4) Communication with other classes/schools (2) Low cost for acquiring mobile devices (2)
Conditions for mobile device usage in class	Existence of the necessary resources/ availability of devices for each student (15) Smaller number of students in class (10) Absence of student abuse/students to navigate (only) specific websites (10) If legislation permitted their use (6) Student maturity (4) Teacher training (2) Existence of appropriate applications for my lesson (2)

pages) (21 references), the noise/disruption in class (13 references) and students' distraction (11 references). Although these teachers do not use tablets or mobile phones in the classroom, they believe there are advantages/benefits when these devices are used for educational purposes: for example, active involvement/interest/motivation of students (16 references), interactive/enjoyable lesson (12 references) and easy access-display of information (9 references). The conditions under which they would use mobile devices in the classroom had mainly to do with the existence of the necessary resources and the availability of mobile devices for each student (15 references), the smaller number of students in class, and the absence of student abuse.

Some excerpts from teachers' answers are presented below (the teacher's specialization is in brackets). Regarding the reasons for not using mobile phones/tablets and the perceived barriers, they said: "Because we do not have mobile devices and I also use a desktop computer" (IT teacher), and "There is a difficulty in moving the devices. I would like a classroom with the necessary equipment and internet… the mobile devices are not enough for all colleagues, internet connection is poor and often slow" (Greek literature teacher). The accessibility to mobile technology was also voiced by other participants, for example, "The school does not have mobile devices and the computers in the computer lab are only a few. Students are not sufficiently familiar with educational programs, they are not ready to accept a different (teaching) approach to the subject/lesson" (Mathematics teacher). Other excerpts associated with barriers were: "I do not know enough their use to be able to stand up to students who are very familiar with these new technological tools" (English teacher), "It is not appropriate to my lesson, while it may distract the students" (Mathematics teacher), "The nature of the literary courses requires dialogue with students. Teaching with mobile devices can only be complementary after having completed the lesson/unit" (Greek literature teacher), "Tablets, mobile phones are banned" (literature teacher), "When it comes to mobile phones and tablets, I think they have no advantages at all" (Sociology teacher).

With regard to perceived concerns, teachers worried about students' behavior and (potential) irresponsible use of mobile technology. For example, "Students are tempted to surf on Web pages other than those related to the lesson" (Home Economics teacher), "Abuse of mobile phone or tablet…while they (students) need to be on a specific website, students could use facebook or games" (Science teacher). Teachers also shared concerns about the difficulty in controlling/managing the class (a consequence of student behavior), for example, "It's difficult, it's impossible to control access to online apps/games" (Greek literature teacher).

Regarding perceived advantages/benefits of mobile devices for educational purposes, some excerpts were: "Quick access to information. It increases students' interest" (Home Economics teacher), "The easy access to information certainly plays a role, so that the class can communicate with other classes of other schools, inside and outside Greece, (they help) in implementing European programmes etc." (English language teacher), "Students enjoy using their mobile phones as these devices are in their daily lives and students are very familiar with their use. It is definitely more enjoyable" (Science teacher), "A key advantage is that they (students) can see things that cannot be done on the blackboard and they can participate in the

exploration of the lesson" (Mathematics teacher), "There are literacy applications/programs that make the lesson more enjoyable and fast and productive. So students are alert and are not easily distracted" (Greek literature teacher), "Mobile devices provide visual experiences for construction, experiments in science and technology" (Technology teacher).

Excerpts regarding the conditions under which these teachers would use the devices in the classroom were: "in case we had the necessary technological infrastructure and devices" (English teacher), "having classroom facilities and the ability for all students to use mobile devices" (IT teacher), "if students did not make abuse/misuse of the mobile phones" (Science teacher), "students (need) to deal only with the lesson taught and not with other things" (Greek literature teacher), "if I had smaller number of students in class and more mature students" (Foreign language teacher), "if it was permitted by the law" (Religion teacher).

Discussion and conclusions

This study investigated Greek secondary school teachers' perceptions of the benefits and barriers, as well as their concerns, to using mobile phones and tablets in the classroom. The study was conducted with a small sample (64 teachers) and its findings cannot be generalized. However, the findings reflect a situation in a micro-level and can contribute to the enrichment of the literature in the field of mobile technology and learning. Mobile learning has not been systematically integrated into the curriculum at various education levels (Bai 2019). Investigating teachers' mobile technology/learning perceptions is important since their perceptions affect the actual use-integration of mobile technology in the classroom (Kim and Kim 2017; Khlaif 2018).

With regard to the first research question (What are teachers' perceptions of the benefits of using tablets and mobile phones in the classroom?) more than half of the sample pointed out several benefits of using these devices for educational purposes. Teachers' major perceived benefits were students' active involvement/motivation, the interactive-enjoyable lesson, the easy access to information and students' familiarity with technology. The most commented benefit was that these devices promote/increase students' participation and engagement, a view also expressed by around one third of the participants who do not use tablets and/or mobile phones in the classroom. If students are motivated and enjoy learning, there is a higher chance that it will affect attainment and progress. The above findings are in agreement with earlier research (Thomas et al. 2014; Taleb et al. 2015; Kousloglou and Syrpi 2018; Kafyulilo 2014) which reported on secondary education teachers' perceived mobile technology benefits (student engagement/motivation and pleasant/interactive lesson). Eschenbrenner and Nah (2019) stressed the need to identify and develop positive affordances that can facilitate learner engagement and address negative affordances to generate the most positive learning and performance outcomes. The finding that some of the teachers who do not use tablets and/or mobile phones in the classrooms perceive these devices as useful, can be explained as follows: around one third of no-users (18 out of 50 teachers) reported they use another technology

(Table 3) and they probably link benefits arising from computer/laptop usage to tablet/phone benefits, while some perceived barriers were similar to ICT barriers.

With regard to the second research question (What are teachers' perceptions of constraints/barriers and their concerns associated with tablets and mobile phone usage in the classroom?) the greatest barrier reported by around one third of the sample was the lack of (or limited) equipment and afterwards the current legislation on the use of mobile phones and tablets. Some of the teachers who do not use these mobile devices in the classroom stated that they use other technologies (such as laptops or desktop computers), as well as that they lack the necessary skills/knowledge, or that these devices are not appropriate for their specialization/lesson. These perceived barriers/obstacles have implications for teacher training, and this is discussed later on. Teachers' perceived barriers are partially in line with the findings of earlier research, in particular, the lack of equipment (Thomas et al. 2014; Lucas 2018) and the low level of comfort with the use of mobile devices (Black-Fuller et al. 2016). There is also an agreement with teachers' perceived ICT barriers (Nikolopoulou and Gialamas 2016); lack of equipment, lack of internet access and large number of pupils in the class were major perceived barriers to the use of computers in Greek high schools.

In this study, teachers' perceived concerns were mainly associated with (potential) students' abusive behavior and the difficulty in controlling the students (classroom management problems); shortly thereafter, the noise/disruption in class and students' distraction were reported. It is noted that the concerns expressed are interrelated as, for example, when students access unintended resources/apps and are distracted by irrelevant information, they (may) show abusive behavior and this may result in classroom management problems and class disruption (teachers face difficulty in monitoring/controlling students' mobile device usage etc.). Similar concerns about ethical issues and students' disruptive behavior were reported by secondary school teachers in earlier studies (Olufadi 2015). Concerns about e-safety and data protection which were highlighted in earlier research (Whyley 2018) were not mentioned by the participants, and this has also implications for teacher training (discussed later on). Teachers did not express concerns/skepticism about students doing worse in exams (as reported by Wexler 2019, in the USA); this is because teachers have little or no information on existing evidence (and, in general, there is still limited evidence on students' learning/performance via mobile devices). Furthermore, those teachers who do not use tablets and/or mobile phones in the classrooms stated as conditions for their use, the same as their perceived barriers/obstacles and concerns; e.g., the availability of the necessary equipment or devices for each student, the smallest number of students in class, the absence of student abuse and the legislation.

It is noteworthy to highlight the importance of the national policy and the school context. The results relate to the fact that in Greece mobile devices are banned in classrooms; out of the 64 participants, only 14 reported mobile phone/tablet usage in the classroom. Although the integration of mobile devices in Greek schools is negatively affected by the current regulations, some teachers make their own decisions about the extent of mobile technology use in classrooms, in different subjects. The acceptance/willingness of the four head-teachers (school principals)

to participate in the study was also important. The school context often constraints/limits individual efforts, and makes it difficult for mobile technologies to be explored pedagogically (this is an issue for future research). Earlier ICT related research indicated that school culture/context influences teachers' perceptions and use of technology (Somekh 2008; Ertmer and Ottenbreit-Leftwich 2010). Processes of change in schools and classrooms cannot be understood in isolation because they are constrained or enabled by the regulatory frameworks/policies of national education systems and national cultures (Somekh 2008).

The ever-growing possession and use of mobile devices is no guarantee for learning. Mobile technologies and wireless internet access provide opportunities for learning, subject to conditions (e.g., way of integration, teacher pedagogical strategies, and application/software appropriateness). Any initiatives to use-integrate tablets and mobile phones in the classroom have implications for students and teachers. For example, students should be informed through discussions and appropriate examples of the safe use of mobile phones both in the educational process and in their everyday lives. In this way, the barriers of student abuse of mobile devices and the surfing on inappropriate pages could be overcome. Recently, the Ofcom report (2019) indicated that only a third of 12–15 year olds correctly understand search engine advertising; school leaders and teachers have an important role in supporting students' opportunities for safe and meaningful use of digital technologies. Teachers' planning decisions about how to use technology tools are critical to securing learning benefits. It is necessary to train teachers in acquaintance/selection of appropriate applications, classroom management and student guidance (e.g., following the school rules and avoiding mobile devices problematic use). For example, workshops were shown to support teachers in recognizing the educational potential of mobile phones, in learning how to use them in science teaching and learning, and in changing their attitudes (Ekanayake and Wishart 2015). As the Greek official curriculum does not include/provide guidelines on mobile devices' usage in classrooms, their use (and consequently mobile learning) could constitute a sub-unit of teachers' ICT pedagogical training. Teachers' professional development will equip teachers with the necessary knowledge, skills and confidence. The role of the teachers is essential in the whole process of integrating mobile technology in classrooms and in expanding students' experiences; for example, they will choose appropriate/sound teaching-pedagogical approaches and they will design, implement (and evaluate) appropriate learning activities for their students.

Recommendations for school policy and practice include the initiation of discussions about using tablets and mobile phones for educational purposes, informing parents of any educational activities/initiatives involving mobile technology, and of course, increased communication among teachers who use and do not use mobile devices in the classroom (the latter one is not to be taken for granted). New school policies need to establish clear guidelines and pay attention on mobile devices' usage, security and behavioral issues. Mobile devices need to be introduced in a planned way that takes full account of the school's vision, as well as of the technical infrastructure, support and staff professional development. The role of school leadership is important in supporting (or not) teachers' efforts to introduce and experiment with mobile technology uses. In parallel, educational

policy makers need to provide practical and educational support. For example, they need to develop policies focusing on how to use mobile devices (tablets, mobile phones, etc.), on safety, on behavioral issues, and on pedagogically appropriate mobile educational applications. Educational policies need to address issues such as ownership of mobile devices, tools to support curriculum, appropriate behavior in school (and other contexts) and privacy-security of data (photographs, video etc.); in order to avoid distraction in class, cheating and inappropriate behaviors. Help desks, instructional assistance and support services are recommended as methods to facilitate the integration of mobile technology in the classrooms. It is possible that for mobile technologies to have more of a positive impact on students' learning, curriculum documentation should address the above issues. It is a challenge to establish productive communication among educational stakeholders (policy makers, curriculum planners, teacher training institutions, school leaders etc.) to advance mobile technology's support as an educational tool in secondary classrooms.

Limitations and future research

Limitations of this study include the small sample size and the lack of differentiation between tablets and mobile phones. Since all teachers participated voluntarily, it could be that, predominantly, the technologically inclined teachers accepted/participated (e.g., around one third of the teachers who do not use mobile phones/tablets in the classroom, reported they use another technology such as desktop computers). Additionally, the views of the four school principals (who accepted to participate) were not investigated; they were the gatekeepers and without their permission it would not have been possible to get access to the schools and explore teachers' views. The limitations are planned to be taken into account in the large research project which is in progress. It is planned to compile a questionnaire for the investigation of teachers' perceptions on mobile technology, including the different types of devices; this will be administered to a large teacher population of different educational levels, across the country. Teachers' perceived benefits, barriers and concerns about using mobile devices for educational purposes, constitute empirical data that can be further enhanced with clarifying questions (e.g., by collecting qualitative data through interviews). For example, for those teachers who use mobile phones and tablets in the classroom, it would be useful to explore (apart from the frequency their usage) the specific learning activities carried out in different subjects. Currently, empirical evidence on how mobile phones or tablets are used in classrooms in different subjects is in embryonic stage (e.g., for science, Nikolopoulou and Kousloglou 2019).

Future research is planned (and recommended) to investigate small-scale practices of (volunteer) teachers who try out appropriate uses for mobile technology in classrooms; in particular, it is essential to identify innovative teachers who are willing to integrate mobile phones/tablets as supportive-complementary educational tools to traditional teaching and to record the relevant activities in different curriculum areas. The school context and the school principals' views/

role will be explored, since these factors are important for teachers' views-practices. Additionally, students' positive feelings (interest, excitement) are a starting point for exploring the degree of their involvement/engagement in the educational process. Parents could also be informed of the learning purposes of mobile devices and be involved in ethical arrangements. Although mobile learning is a widely adopted mode of education nowadays and a number of papers have been published (Elaish et al. 2019), more evidence is needed on how students learn when using mobile devices in the classrooms.

Mobile devices are clearly becoming an essential part of everyday life and learning through these is an evolving field of research. Each generation of new mobile devices has increasingly more sophisticated features like email, cameras, picture quality and stronger Wi-Fi connection. Consequently, it is important to investigate teachers' perceptions over time, as these are expected to influence their classroom practices. Future research is also suggested to investigate what are the most effective pedagogical practices to support the educational process, when integrating mobile phones and tablets. What are the new emerging literacies resulting from students' use of mobile technology? As the boundaries between palm computers and mobile phones are constantly being revised, the capabilities of mobile devices are improving and new (educational) applications/tools for mobile devices are being developed, their future use to support learning is an issue to be explored.

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Compliance with ethical standards

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