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Students' Mobile Phone Practices for Academic Purposes: Strengthening Post-Pandemic University Digitalization

Kleopatra Nikolopoulou

School of Education, National and Kapodistrian University of Athens, 10680 Athens, Greece; klnikolop@ecd.uoa.gr

Abstract: The COVID-19 pandemic is considered as a turning point that has impacted the digital transformation of higher education. However, the link between students' mobile phone practices and university digitalization is not sufficiently or explicitly discussed. The purpose of this study is to provide evidence about university students' mobile phone practices for academic purposes, and to contribute to the debate regarding post-pandemic university digitalization. The participants were 60 students studying in a Greek university, data were collected via an open-ended questionnaire, and descriptive content analysis was used to examine the qualitative data. Students mainly use their mobile phones for information searches (e.g., for assignments, videos, photos, graphs, simulations, online dictionaries, and scientific papers), easy and quick access to e-classes (e.g., course material/slides) and the faculty's site, and for communication with peers (e.g., queries, sharing educational resources) and tutors. During mobile practices, students experience advantages (easy-quick searches, flexibility, familiarization with digital technology) and disadvantages (internet connectivity, unreliable information sources, distractions). Implications for students, educators, and university policy-organization (policymakers have a role in reshaping digitalization) are discussed. It is argued that mobile learning has the potential to strengthen university digitalization, thus affecting the sustainability of education in the post-pandemic era.

Keywords: mobile phones; mobile learning; university digitalization; student practices; digital technology

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1. Introduction

Digital technology has changed many aspects of universities, including how research is carried out, and how students study, access their grades, and communicate with their tutors and peers. The use of digital technologies/methodologies in education is on the rise, in particular, after the COVID-19 pandemic [1–5]. The recent pandemic can be considered as a turning point for many dimensions, including digital education. Digitalization is taking place in universities [6] and lately there has been a rise of online distance education and blended-hybrid modes of education [7–11]. The pandemic accelerated the digital transformation of higher education [6,11,12], while mobile technology-mediated learning was implemented by many university students and it supported online learning [13–16].

Mobile learning (m-learning), among others, is ubiquitous, flexible learning, supporting personalization [17,18], and it has an educational, pedagogical potential that can impact positively on learners [19]. The use of mobile phones/devices for educational purposes can support and enhance the learning process, anytime and anywhere [20,21]. Mobile phones offer various features such as word-processing, internet access and e-mail, while university students use these devices for multiple tasks such as accessing course resources [22,23], downloading/reading books and supporting information via the internet, interacting with tutors [12,22], watching videos, and communicating with fellow students [24,25]. It is noted that today's university students (age range: 19–24 years old) have grown up in a world that has always been digital and interconnected, a world different to the world of their parents

and university educators because of the rapid rate of technological change. "Today's students are no longer the people our educational system was designed to teach" [26] (p. 1). Prensky [26] described this group as *digital natives*, arguing that they use digital technology differently in comparison to prior generations, who he refers to as *digital immigrants*. Digital natives adopt mobile phone use for their studies, and make extensive use of the internet via their mobile phones [27,28].

The purpose of this study is to provide evidence about university students' mobile phone practices for academic purposes, and to contribute to the debate regarding post-pandemic university digitalization. The discussion in this study has broader generalization potential on other contexts, aiming to be of international interest. It is important to understand university students' educational mobile phone/technology practices since these, together with other factors (educators' digital practices, university policy, etc.), can strengthen the digital transformation of university in the post-pandemic era. Digital transformation in higher education is an evolving trend, while the link between students' mobile phone practices and university digitalization is not sufficiently or explicitly discussed in the literature. Since after the pandemic many universities are experiencing digital transformation [6,11,12], it is critical to identify dimensions/factors that are potentially associated with digital transformation of education. It is essential to maintain the continuity and sustainability of education [2] in times of future crises such as disasters and pandemics.

The rest of the paper is organized as follows: Section 2 discusses the background of the study, Section 3 indicates materials and methods, Section 4 presents the results, Section 5 regards the discussion and implications, and Section 6 addresses the conclusions and future research.

2. Background

2.1. University Digitalization in the Context of the COVID-19 Pandemic

The digitalization of higher education is both a top-down and bottom-up approach [29] and under the pandemic disruption, digitalization provided an alternative solution for higher education practices [30]. Digital transformation of the educational environment (e.g., of a university) is associated with various factors, such as the process of technological equipment, changes of an organizational, managerial, and cultural nature, as well as teacher–student communication [31]. From the beginning of the pandemic until now, a number of studies have explored university students' and educators' experiences and perceptions of online learning and teaching [1–6,11,14], as well as (perceived) benefits, challenges, and opportunities for blended education [9,10]. Technological resourcing of institutions (hardware devices, software, and infrastructure), digital skills/competences of teachers and students, and digital inequalities (the digital divide exists among students as they come from different socioeconomic backgrounds) were often investigated in association with digitalization [32]. Others [29] explored the aspect of digital learning spaces and provided recommendations for universities (adoption of learning-centric approach to digital transformation by integrating technologies, pedagogies, and organizational measures), educators (movement from lecturing to orchestrating digital resources) and students (improvement of their competencies to work in hybrid settings). However, the issue of students' mobile phone practices and university digitalization is not explicitly discussed. Issues associated with post-pandemic university digitalization constitute an emerging body of literature.

For the purpose of this paper the term *digital technology* is treated as synonymous to *ICT* to indicate any forms of technology used to store, display, process, transmit, share, or exchange information by electronic means, which includes mobile technology/applications as well. *Mobile learning* is defined as the process of learning mediated by mobile devices, anytime and anywhere with no restrictions on time and location [33] considering the mobility of technology, learners, and learning. *Online learning* is conducted via the internet and is distinct from distance learning, although these terms are increasingly used interchangeably. *Hybrid (or blended)* education takes place partially on the internet; this may include some

students being in class while others are online or all students meeting part of the time online and part of the time face-to-face [34]. The terms *digital natives* and *digital immigrants* are used because they still attract readers' attention. The concept *digital wisdom* [35] is used synonymously to the term *digital natives*; it presents a view of the coming era when all students and educators will be born in the 21st century, highlighting how to use digital technologies to become better, wiser people [35].

2.2. University Students' Mobile Phone Practices

In the studies discussed in this section students use their mobile phones either for their online courses during the COVID-19 pandemic, or for academic course-related activities (courses not designed for mobile learning); the focus is on the recent studies published during 2021 and 2022.

Elliott [36], in the USA, indicated that university students do use their mobile phones for significant amounts of academic work and consider them to be important educational tools; about half of the sample agreed that having access to their course materials on their smart phone would help them succeed in achieving their degree. Examples of smart phone uses include supplementing their notes by taking photos of whiteboards or course materials, reviewing due dates, grades, or assignment requirements, communicating with instructors, reading notes, and listening/watching to assigned audio/videos. Barriers that students encounter when using their mobile phones for formal learning are technological (related to the usability of the hardware or software itself, small screen size, etc.), institutional (e.g., functionality differences between platforms) and instructional (difficulties in accessing learning materials or participating in academic work due to flaws in the instructional design).

Milheim et al. [37], in the USA, indicated that college students voluntarily use mobile devices (phones and tablets) for online course work or course-related activities: e.g., taking notes, reading/downloading course materials, and communicating. Most participants use mobile devices for convenience, portability, and ease of use, while challenges when using mobile technology often relate to technology limitations (compatibility issues, device design).

Fu et al. [28], in China, investigated students' educational smartphone use in learning settings. It was shown that, besides socializing and learning, there are many reasons/motives for students to use their smartphones. Students with strong goal achievement orientation are more likely to use their smartphones for educational purposes. Student activities include use of instant messaging apps and video apps.

Among studies of mobile phone practices within specific subjects, English as a foreign language (EFL) is often explored [38,39]. Jeong [38], in Korea, found that the incorporation of mobile applications into language learning can foster learner motivation and make learning more sustainable; students' major perceived benefits were ease of access to learning contents, portability, flexible and self-directed learning environment, better interaction, and improved self-efficacy in English learning performance. Alrefaai [39] showed that EFL students use their mobile phones for academic purposes in an online learning environment, but they also face some challenges such as technical difficulties, the small size of the screen, distraction, and getting tired. Hranchak et al. [40] investigated Ukrainian and USA information science students' mobile phone practices to understand participant preferences and set a baseline understanding for the development of prospective library informational mobile services. Such services may include information and reference service via messengers, development of library mobile applications of audio and video content, and access to educational, scientific, popular science literature and fiction. In parallel, various studies across the globe reported that mobile phone/apps supported university students' learning and communication during the COVID-19 pandemic: e.g., studies undertaken in the Philippines [13], Saudi Arabia [41,42], and Canada [43].

Within the Greek context, the use of mobile phones/devices in university classrooms is not banned; it is up to the individual educators to ban or allow/encourage their use

in lessons. The ITU report [44] ranked Greece among the higher scoring European nations in the Information and Communication Technologies Development Index. Although all university students own a mobile phone with internet access, there are only a few studies regarding students' educational practices/perceptions. One study [27] provided evidence on mobile phone acceptance among university students. The most important predictors for students' behavioral intention to use mobile phones for academic purposes are habit, performance expectancy, and hedonic motivation, while intention strongly predicts students' actual mobile phone use. Gender or age differences were not found when evaluating students' intention to use or accept mobile phones/devices [27,45]. Another study [46] indicated that different factors such as performance expectancy, hedonic motivation, and facilitating conditions influenced student teachers' intention to use mobile devices for learning.

Due to the limited empirical evidence on the topic, the current study was considered as necessary. In particular, the link between students' mobile phone practices and university digitalization is not sufficiently or explicitly discussed. University education is experiencing an ongoing rapid digitalization and although a body of literature is accumulating, there is still a need for investigations that can be useful for higher education internationally [6]. As mentioned earlier, it is the author's position that the discussion in this study has broader generalization potential and is of international interest/concern.

3. Materials and Methods

3.1. Research Questions of the Study

The following research questions were addressed:

1. Why do university students use their mobile phones for academic purposes, and what are their main practices?
2. What advantages and disadvantages do students encounter when they use their mobile phones for academic purposes?

It is noted that mobile phone use is not obligatory; the students choose to use the device for educational activities-practices.

3.2. Sample and Procedure

Participants were recruited by using convenience sampling methods. The inclusion criteria required that students were in their third year of studies or above, in order to have had university experience of both face-to-face and online teaching during the academic years 2021–2022 and 2020–2021, respectively. The sample of the study consisted of 60 students at a public university in Northern Greece; participants were of similar socioeconomic background (low to average). The research was qualitative and ethical issues were considered according to the new General Data Protection Regulations (GDPR); ethics are important in qualitative research [47]. The participation of the students was voluntary. 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 input would remain anonymous; the data gathered will be used solely for research purposes. Official permission was obtained from the university's ethics research committee. Demographic characteristics of students (gender, age, year of study, field of study, frequency of using their mobile phone for academic purposes) are shown in Table 1. 36 students were women, 24 were men; the majority of students (N = 52) were in their 3rd year of study; the age range was 19–24 years old; about half of the sample were in the science department, and one third in the accounting and finance department; regarding the frequency of mobile phone use for academic purposes, about two thirds of the sample (N = 46) reported 3–5 times or 6–10 times per week.

Table 1. Demographic information of students (N = 60).

Gender	Year of Study	Age
Female (36)	3rd year (52)	19–20 (23)
Male (24)	4th year (8)	21–22 (33) 23–24 (4)
Field of study—Department	**Frequency of using the mobile phone for academic purposes**	
Science (37) Accounting and Finance (19) Business administration (4)	3–5 times per week (24) 6–10 times per week (21) More than 10 times per week (15)	

3.3. Research Instrument and Data Analysis

The data were collected via an anonymous paper-based questionnaire in October 2022. As ethical guidelines were followed, the students completed the questionnaires at a time-period where their studies were not disturbed. The questionnaire was constructed by the author for the purpose of this study, taking into account earlier research, and included open-ended questions; open-ended responses to a questionnaire are qualitative documents and such practices are in line with qualitative research [47]. Open-ended questions are exploratory in nature and enable the respondents to express themselves in their own words. The general axes of the questionnaire were related to the research questions and were: Why do you use your mobile phone for academic purposes? Which activities do you perform with your mobile phone for academic purposes? What advantages/benefits and disadvantages/barriers do you encounter when using your mobile phone for academic purposes? The questionnaires were distributed and collected by the author in case any clarifications were needed. The second section of the questionnaire aimed to collect information regarding students' demographic characteristics (see Table 1). Descriptive content analysis was used to examine the qualitative data collected through the documents with the aim of summarizing the informational contents of these data with respect to the research questions. The completion of self-reported questionnaires poses methodological challenges; for this matter, anonymity was confirmed so as to eliminate possible untruthful responses. Students' responses are presented according to the research questions of the study.

4. Results

4.1. Reasons for Using the Mobile Phone for Academic Purposes and Activities Performed

The reasons for using the mobile phone for academic purposes and indicative examples of activities performed, as reported by the students, are shown in Table 2. The majority of the students (55 out of 60) report they use their mobile phone in order to search for information in search engines; indicative educational activities include searching information for assignments, videos, photos, graphs, simulations, online dictionaries, scientific papers, and solutions for course exercises. They also use their phone for easy and quick access to e-class (51 references); examples of activities include access to course educational material, tutors' slides, course announcements, assignment requirements, and access to their grades. Many students (46 references) reported, as a reason, accessing the faculty's/department's site in order to obtain immediate information about announcements and the programme of studies. Communication with peers was mentioned by around half of the sample; indicative activities were asking queries about assignments, sharing educational resources, and exchanging ideas. Other reasons included communicating with tutors (e.g., sending queries or assignments), searching and downloading e-books, watching videos, using the calculator function, as well as taking photos and recording lectures.

Students were also asked to note whether their academic activities/practices have changed after the pandemic, and in what way. A total of 42 students answered positively, but very few students provided an explanation. This, together with their relatively short in length responses in the open-ended questions could be attributed to the fact that *digital na-*

tives (especially, those studying practical and not theoretical subjects) are not accustomed to writing. Though it is beyond the scope of this paper, it constitutes an issue for investigation.

Table 2. Reasons for using the mobile phone and activities performed (N = 60).

Reasons-Purposes for Mobile Phone Use	Examples of Activities Performed
Information search in search engines (55)	Search for information for assignments (37) Search for videos, photos, graphs, simulations (32) Search for online dictionaries (terminology in Greek and foreign languages) (19) Search for scientific papers (8) Search for solutions in their course exercises (3)
Easy and quick access to e-class (university's platform) (51)	Access to course educational material, tutors' slides (48) Constant access to course announcements, assignment requirements (41) Access to grades (33)
Accessing a faculty's/department's site (46)	Immediate information about announcements, programme of studies (43)
Communication with peers (35)	Queries about assignments (32) Share educational resources (21) Exchange ideas/opinions (18)
Communication with tutors (28)	Queries, send assignments (26)
Search and download e-books (11)	E-books relevant to course, assignments (10)
Watch videos (10)	Videos relevant to specialization (8)
Use of calculator (10)	For exercises (8)
Take photos, record lectures (7)	Photos of course materials/whiteboard (3) Audio recording of a lecture (3) The phone as a library of educational resources (2)

Indicative excerpts from the questionnaires are presented below. The predominant reasons-activities were related to information search, accessing e-class and the faculty's site/platform: "The reason I use the mobile phone is to search for information about assignments and access academic material"; "Instant, fast, easy access to information"; "I use it for extra educational resources and for e-class"; "I enter e-class, to access course educational material, to be informed about assignments"; "I read through e-class, search for information about unfamiliar terms"; "(I use it) for entering the Faculty's site, to check announcements, our programme, etc."; "I search for e-books in English language"; "I search to find photos, foreign concepts/terminology, e-books"; "I check phrases and terminology in online dictionaries".

Examples of other activities include: "I watch tutorial videos that help me understand better a part of the course that I find difficult. I read the same theory from different websites"; "I look for information on the internet, I communicate with my fellow students or tutors about assignments"; "Verifying results and creating graphs in mathematics or physics; using Excel, Geogebra"; "I store and read educational material".

Regarding possible changes of educational practices after the pandemic, some students voiced: "After the pandemic I use it (mobile phone) for more activities"; "After the pandemic we use it more, we have better communication with tutors and peers, and we became familiar with technological means"; "After the pandemic I use it more easily".

4.2. Advantages and Disadvantages Experienced by Students When Using Their Mobile Phones for Academic Purposes

The advantages/benefits students experience when using their mobile phones for academic purposes regard the following: easy and quick searching for information (45 references), immediate access to e-classes (42), easy access anywhere-anytime, flexibility,

portability (34), easy-convenient communication with peers and tutors (24), familiarization with digital tools (16), and motivation/interest in academic subjects (12); see Table 3. Major perceived disadvantages/obstacles experienced mainly concerned internet connectivity (e.g., not always available, traffic overload in platforms), battery life (28), unreliable sources of information (17), small screen size, and distractions. Around 10 students did not mention any obstacle. Students were also asked to mention their suggestions for mobile phone usage; however, in this question, very few students made suggestions such as integration of mobile phones in the learning process (14 references), and tutors encouraging phone usage in their classes (11).

Table 3. Advantages and disadvantages experienced by students.

Advantages/Benefits Experienced	
Easy and quick search for information	45
Immediate access to e-class (e.g., in comparison to laptop)	42
Easy access anywhere, anytime, flexibility, portability	34
Easy, convenient communication with peers and tutors	24
Familiarization with digital tools (e.g., for assignments)	16
Motivation, (increased) interest in academic subjects	12
Access to timely, recent information (e.g., text, video) on a subject	10
Disadvantages/Obstacles experienced	
Internet connectivity and battery life	28
Unreliable/invalid sources of information	17
Small screen size (causes eye strain, etc.)	13
Distractions (social media distract the learning process)	11
Multiple operating systems, incompatibility (sites not designed for phones)	9
Difficulty in writing reports, assignments (e.g., in Word)	5
Suggestions for mobile phone use for academic purposes	
Phones to be integrated in the learning process (e.g., due to limited university infrastructure)	14
Tutors should encourage mobile phone use in their classes	11
Grants/vouchers, free internet for students	8
Use of calculator in exams	6

Examples of statements regarding student experienced advantages (when using their mobile phones for academic purposes) were: "It (mobile phone) provides immediacy and flexibility: no need to switch on the laptop"; "I can easily, whenever I want, wherever I am, to read the teacher's slides"; "Greater interest in the immediate search for information, practical because I don't carry heavy books"; "Easy and quick conversion of measurement units"; "Interactive experiments".

Examples of disadvantages, as expressed by students include: "Connectivity difficulty, eye strain"; "Network overload and weak signal"; "Many articles and sources are unreliable. Especially in Greek language there is not much scientific material available (on the internet)"; "Incorrect data, unreliable sources"; "Many sites not designed for mobile phones". Finally, some suggestions from the students were: "(Mobile phones) to be integrated into the course for various uses"; "To be integrated into the courses due to insufficient university resources"; "(university policy) to hand out vouchers to students, and to use the calculator in exams".

5. Discussion and Implications

This study explores Greek university students' mobile phone practices for educational purposes; an underexplored area in Greece and also internationally. It is argued that students' mobile phone-mediated educational practices contribute to strengthening the digital transformation of universities in the post-pandemic era. The increasing utilization of mobile phones for educational purposes advances the digitalization process in universities.

Digital transformation impacts on sustainable university [12]. The results may be useful for university tutors and policy makers in the post-pandemic era.

The findings reveal that main purposes for using the mobile phones range from searching for information and accessing e-class/faculty sites, to downloading educational/course materials and communicating with peers/tutors. In correspondence to these purposes, the mobile phone-mediated activities for academic purposes include searching for information for, e.g., assignments, videos, photos, graphs, simulations, online dictionaries, scientific papers, accessing course educational material, announcements, and assignment requirements, as well as asking queries, sharing educational resources, exchanging ideas, and watching videos. Several of these activities are in agreement with recent research which indicated mobile phone usage for finding information, downloading and reading course materials [37], assignment requirements, watching videos [36], and communicating with peers/tutors [28,36,37].

The advantages/benefits participants experience when using their mobile phones are related to their activities and regard quick searches for information, immediate access to e-classes, flexibility (access to information/material anywhere, anytime), portability, easy communication with peers/tutors, familiarization with digital tools, and interest for academic subjects. In alignment with recent research, students value mobile phone usage for ease of use/access, convenience, portability [37,38], and easy communication [37]. Disadvantages/obstacles often relate to internet connectivity, unreliable sources of information, limitations of the devices (e.g., small screen size, compatibility), and distractions. University students in other countries also encounter similar barriers, e.g., technological barriers [36,39], distractions, and eye strain [39].

Despite the obstacles, students' practices and positive experiences are basic points for mobile learning integration in higher education. University students who (voluntarily) use their own mobile phones for academic purposes hold positive perceptions of using mobile devices [27,37,48]. Taking into account recent research and the findings of this study, it is argued that student mobile phone practices (in combination with other factors such as educators' practices and university policy) constitute a basic factor for university digitalization. It is suggested to encourage university students' mobile phone practices for academic purposes. Earlier research [49,50] pointed out that "digital natives" are used to being online (e.g., communicating with their friends/peers via mobile apps), they bring and use their mobile phones all the time, and they often have a low capacity for traditional lectures' attention. These characteristics should be taken into account in the implementation of bring your own device (BYOD) policy, and the pedagogical use of mobile devices for supporting/enhancing traditional lectures. Since mobile technology activities and the organization of the m-learning environment affect students' learning outcomes, the role of educators and institutional policies affect mobile pedagogies, and contribute towards the digitalization of education; processes of change in universities cannot be understood in isolation because they are constrained or enabled by the policies of national education systems. Although the findings of this study derive from a specific sample, these constitute a starting point in order to discuss the potential of mobile learning to strengthen university digitalization. Thus, the discussion and implications have broader generalization potential on other contexts, geographical or cultural areas.

5.1. Implications

There are implications for students, educators, and university policy/organization. Initially, university students should receive training with regard to effective mobile phone/device usage for academic purposes. Librarians could, for example, organize workshops for students, to expose them to ways of using their mobile phones to access electronic databases. Workshops within the context of collaborative learning [51] could also be considered. Mobile technology-mediated practices for academic purposes are often student-initiated [37], and this should be understood by educators. Educators should take student practices into consideration, recognizing them as important when implementing mobile learning

environments. The majority of university educators are actually digital immigrants [26]; to a large degree, university class teaching is traditional, reflecting the expectations and the world of the educators rather than the students. However, the COVID-19 pandemic forced educators to radically change how they teach (by using various digital platforms and tools), and opportunities arise for the post-pandemic era: e.g., the enhancement of educators' digital technology and online pedagogy skills; integration of digital tools in universities, the adoption of more flexible and mobile forms of teaching and learning, and the creation of digital educational resources. Educators could design pedagogical interventions that incorporate mobile phones as learning tools. Although university students have access to a range of digital tools for academic learning, effective outcomes depend upon educators and the university policies [52].

Digitalization concerns educational stakeholders [52], and policy makers could be, from example, from the Ministry of Education or from individual universities. University policy and organization is suggested to encourage the integration of mobile/smart phone practices for educational purposes. After the recent COVID-19 pandemic, mobile learning is expected to play an increasingly important role in university teaching and in hybrid-blended courses [53]. Educational policy initiatives support the digital transformation of higher education and the sustainable adaptation of education to the post-pandemic era. Since digital transformation involves (re)adjustment [11], policies could be re-considered to adopt hybrid-blended modes of education (these can be supported by mobile learning/practices), and enhance organizational, technological, and academic management. Initiatives such as help-desks and support services are recommended to facilitate mobile technology-supported educational practices. University developmental strategies are suggested to include blended modes of education and increase investment in innovative technologies (e.g., infrastructure linked to hybrid activity events, since the current tendency is not going back to just face-to-face events). More efficient, educational mobile phone systems/apps are suggested for design, e.g., tutoring systems that enable learning via mobile devices [54] or applications that facilitate student communication in the context of internationalization in higher education in the digital environment [55]. Since *digital natives (digital wisdom)* intend to continue to use their mobile phones [27,46], it will be useful for universities to invest in mobile infrastructure to enable the incorporation of mobile apps. Furthermore, as students are intense multitaskers employing the latest smartphone technologies, higher education institutions need to have better guidelines to regulate mobile phone use [56].

5.2. Limitations

There are a few limitations in this study that prevent the generalization of results. The number of participant students was small (N = 60), so their reflections are not equally applicable to all student practices/experiences. There was a homogeneity of the sample with regard to students' age (19–22) and the limited spectrum of academic fields attended. However, the findings reflect a situation in a micro-level and contribute to the increasing body of literature on students' mobile phone practices; this study serves as an evidence-based effort contributing to the discussion regarding the post-pandemic digitalization of higher education. The compilation of a questionnaire on student practices has been planned with the aim to be administered to a larger and more diverse population across the country, in order, for example, to identify possible differences across different age groups and academic fields.

6. Conclusions and Future Research

This study provides evidence about university students' mobile phone practices for academic purposes, and contributes to the discussion regarding the potential of mobile learning to strengthen the digital transformation of university in the post-pandemic era; mobile learning is a pragmatic and sustainable approach that strengthens digitalization. It was found that students use their mobile phones for information search (e.g., for assign-

ments, videos, photos, graphs, simulations, online dictionaries, and scientific papers), easy and quick access to e-classes (e.g., course material/slides) and the faculty's site, and for communication with peers (e.g., queries, sharing educational resources) and tutors; that is, mobile phones are used as learning, organizational and communication tools. During mobile practices, students experience advantages (easy/quick searches, flexibility, familiarization with digital technology), as well as disadvantages (internet connectivity, unreliable information sources, distractions). This evidence, that derives from a specific sample (with a similar socio-economic status, from the same country), serves as starting point to discuss the potential of mobile learning to strengthen university digitalization. The discussion and implications have a broader generalization potential for other geographical/cultural areas, aiming to be of international interest. After the pandemic, recognition of university digitalization is growing [6,11,12], and the link between students' mobile phone practices and university digitalization needs more attention (it is not sufficiently/explicitly discussed). It is critical to identify dimensions that are associated with the digital transformation of education.

The findings are mainly important for university educators and university policy and organization. Educators need to be aware of students' mobile phone practices when they design pedagogical interventions in mobile environments; it is important to plan and organize appropriate activities, and create good quality digital resources. The pandemic brought the forced utilization of educational technologies at universities (enforced digitalization). During the pandemic, both students and tutors gathered digital experiences, which is a great advantage for moving forward in the digital transformation of university education [57]. University policy could (re)consider the adoption of hybrid-blended modes of education. After the pandemic blended-hybrid teaching and learning has entered conventional and mainstream education [9] blended teaching and learning could be supported by mobile phone practices, and it is a practical solution and a viable option for providing education in times of disruption and crises. Student mobile phone-mediated educational practices can be encouraged in both face-to-face and hybrid education, in particular in universities with limited infrastructure, or with socially disadvantaged students (mobile phones are usually cheaper than PCs or laptops).

It is recommended that students' mobile phone practices be explored in different contexts (e.g., different universities and countries worldwide) and in longitudinal studies (since practices are expected to change over the time). The mobility and autonomy of self-directed learning via mobile phones can enhance students' interest and engagement with their studies, and it is interesting to explore the sustainability of mobile technology-mediated learning. As the capabilities of smartphones are increasing, mobile technology-supported educational opportunities are evolving. Future research could, for example, investigate innovative mobile pedagogies and opportunities that digital mobile technologies afford for student-educator collaboration to increase student engagement in online environments. Students' and educators' practices, and the factors that support/hinder mobile learning in universities, are issues for further research. Researchers could also pay more attention to the association between student mobile phone practices and university digitalization. Future models should explore online/blended learning adoption and implementation in universities [58,59], or mobile learning in higher education [60], to consider the dimension of student mobile phone practices. For example, models or frameworks aiming to investigate dimensions/factors that affect university digitalization could include the aspect of student mobile phone practices. The way is paved for international conferences to be held in an onsite–online hybrid via implementation of an online platform for online participants (a recent example is the 2022 hybrid World Conference on Computers in Education). In such hybrid events, mobile technology can be utilized. Mobile learning is an example of building on an existing infrastructure; that is, using mobile phones the students already own, routinely use, and are part of their (digital) culture. Indicative questions for future research include: How do student and educator mobile phone educational practices support

hybrid teaching/learning? How might the area of university digitalization develop over the coming years?

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