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Academic Use of Smartphones and Academic Performance in Higher Education: A Systematic Review

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	Abstract
<p>Article History</p> <p>Article Submission 31 March 2023</p> <p>Revised Submission 16 May 2023</p> <p>Article Accepted 14 June 2023</p>	<p>Smartphones may be particularly prone to distracting students, allowing them to spend more time engaging with their devices rather than focusing on academic tasks. The purpose of this study was to explore the impact of the use of smartphones on student academic performance in higher education. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines to guarantee the inclusion of relevant academic materials. We examined 8 out of 299 documents gathered from the Education Resources Information Centre (ERIC), Scopus, and Web of Science (WoS) databases that were published since 2018. During the screening phase, excel files with details about the paper, including title, author and abstract, were exported from the database. Our bibliometric assessment shows that research on the use of smartphones for specific academic purposes has remained scarce in recent years, and most of the studies are located in Asian countries. The research supports that the academic use of smartphones has a significant positive impact on student academic performance in higher education. It shows that using smartphones for learning purposes has various positive effects on students' learning in and out of the classroom, such as motivating students, increasing their collaboration and interaction, and improving their engagement in learning. Also, the study found positive student attitudes toward the use of smartphone-assisted learning apps. We concluded that smartphone use has a significant positive impact on academic performance.</p> <p>Keywords: Smartphone; Academic Performance; Higher Education; Smartphone-assisted Learning Apps; Digital Communication</p>

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Introduction

The COVID-19 pandemic has caused widespread disruptions in the education sector, leading to significant changes in the way students learn and the way institutions operate. With the closure of schools and universities worldwide, many institutions have turned to online learning to continue providing education to their students. While remote learning has allowed students to continue their studies, it has also presented challenges, particularly in terms of academic performance. There is a study from Norway stated that fifty percent of university students in the study believed that switching to online education would present a greater challenge in achieving their learning outcomes (Almendingen, Morseth, Gjølstad, Brevik, & Tørris, 2021). According to a national survey conducted in China, the learning environment is probably one of the most influential factors that are strongly associated with reduced academic performance in higher education (Li & Che, 2022). Remote learning highlights the problems that students and faculty face in adapting to new learning environments and ensuring academic success. In addition, the pandemic has driven the need for flexible and mobile learning solutions that allow students to learn anytime, anywhere. It has accelerated the adoption of technology in education, particularly the use of smartphones. Smartphones improve the convenience of digital learning.

The term "digital learning" is a comprehensive and all-encompassing phrase. Digital learning can be defined as any form of education that is facilitated by technology or instructional methods that make full use of technology. Digital learning encompasses the acquisition of skills related to the effective utilisation of technologies, as well as the utilisation of features such as blended or virtual learning. In addition, digital learning encompasses the utilisation of technological tools, digital materials, and pedagogical approaches.

The concept of 'e-Learning' pertains to a structured educational approach that employs digital resources. It is noteworthy that eLearning, a form of education that can occur both inside and outside of traditional classroom settings, heavily relies on the utilisation of computers and the Internet. In certain instances, there may be a lack of physical interaction between the educator and the learner. It also recommends more attention to the structure of lessons through the development of a graphic charter and a unified structure which will be adopted by the university whenever preparing and presenting lessons (Zehioua, Beichi, & Bara, 2022).

The diversity of teachers' communication abilities via the Internet, particularly in terms of accessing and publishing information, is noteworthy. There exist individuals who are pre-literate, while others make use of the Internet for routine educational and academic purposes. It is a common occurrence for educators to store data in a manner that is easily accessible via the internet. However, the transition to e-teaching represents the subsequent bold move.

The role of the e-teacher is not to possess all the answers and dictate the questions, but rather to become a proficient learner who can assist students in problem-solving and discovering solutions to their inquiries. Consequently, the instructor assumes an integral role in the educational process alongside their students, as they acquire the skills to operate within a facilitative and collaborative e-learning setting.

Small group instructors are required to concurrently manage three primary tasks, namely group management, activity management, and learning management.

Despite the decreasing costs of hardware and software, the deployment of e-learning ventures may incur additional expenses that have not been taken into account. Among the critical factors to consider are the expenses associated with infrastructure maintenance and support, as well as the provision of adequate training to personnel to optimise their utilisation of the technology. The expanded opportunities for teaching and learning in the networked environment of the Internet-connected world are currently being comprehended in a nascent stage. The implementation of e-teaching poses a significant challenge due to the fact that educators of the digital era are being tasked with instructing in a manner that was not utilised during their own educational experiences. The individuals will operate within a setting where they have not previously assumed the role of a student and may have limited personal encounters. However, in the absence of a historical perspective and a comprehensive knowledge base, e-teachers will have the chance to become trailblazers as they embark on their journey.

The opportunity will be presented to them to reconsider the essence of the teaching profession.

Proficient utilisation of mobile applications enables individuals to effectively employ diverse digital devices, such as smartphones, for educational objectives in a sustained manner, while considering the unique personal traits and psychological attributes of each student. These include the capacity for sustained attention, adaptability, speed of comprehension of educational content, and the duration required for adjusting the format of educational material to cater to the student's requirements. Furthermore, various specialised applications have been developed with the aim of offering virtual psychological assistance to students, which can address specific limitations and enhance educational endeavours. The limitations of the distance learning modality, specifically the challenge of conducting hands-on laboratory work in a virtual setting, can be mitigated through the utilisation of dedicated smartphone applications that replicate the complete laboratory experience for students.

By incurring supplementary expenses and investing in the development of a customised application, it is feasible to integrate gamification into the pedagogical approach. This innovative technique of instruction is frequently unfamiliar to the majority of educators.

In the current post-epidemic era, smartphone usage in higher education has become increasingly prevalent. In the educational industry, the information system transition, which is marked by the wide usage of smartphone, has resulted in inevitable consequences (Yang, 2023). Research has shown that smartphone use can have both positive and negative effects on academic performance. It is considered to be portable and convenient and has revolutionised the way we access information and communicate with each other, allowing students to access a wealth of educational content from anywhere and at any time. As the vital part of educational informatization, the application of smartphone optimizes the overall educational process (Xu et al., 2023). At the same time, it can facilitate student-student and student-teacher collaboration (Latif et al., 2019).

Smartphones can also be used to engage students in the learning process through interactive apps and games. This can improve student motivation and learning outcomes (Su & Cheng, 2015). With the widespread adoption of online learning platforms and virtual classrooms, students have increasingly relied on smartphones to access course materials, attend lectures, and collaborate with peers (Irwin et al., 2012).

However, while smartphones provide numerous benefits, concerns have been raised about the impact of smartphone use on academic performance in higher education. There is an ongoing debate over the impact of smartphone use on academic performance. A large amount of research focused on the negative side of smartphone usage (Amez & Baert, 2020). They stated that excessive smartphone use can have a negative impact on learning performance, with students who spend more time on their phones experiencing lower grades. With the proliferation of smartphones, social media apps, messaging apps, and other forms of digital communication in phones may be particularly prone to distracting students, allowing them to spend more time engaging with their devices rather than focusing on academic tasks. Moreover, research has suggested that excessive use of smartphones and multitasking with the phone can lead to decreased attention span, academic procrastination, and lower academic performance (Akinci, 2021).

Additionally, most studies point to a negative impact of smartphone use on academic performance. A systematic review study of 23 papers on smartphone use and academic performance from 2014-2019 showed that 18 out of the 23 papers confirmed the negative impact of smartphone use on academic performance (Amez & Baert, 2020). Few studies have shown the positive side of smartphone use on academic performance, and less attention has been paid to the academic or educational uses of smartphones. It is important to note that the relationship between smartphone use and academic performance is complex and can be influenced by a variety of factors. Since smartphones now play an important role in every student's life, it is difficult to avoid smartphone use altogether. Thus, in such a technological environment, it is crucial for educators to continue promoting responsible smartphone use practices to help students maximize the benefits of mobile learning while minimizing its potential drawbacks.

The purpose of this study is to present a systematic review for 2018-2023 to (1) identify key publications and research trends in the field and (2) explore the impact of the academic use of smartphones on student academic performance in higher education. The following sections demonstrate the methodology used to review the literature, as well as the main findings and conclusions of the study.

Literature Review

The educational productivity theory, developed by Reynolds and Walberg in 1992, posits that academic performance is influenced by several factors such as individual ability, quality of instruction, time on instruction, and motivation. When it comes to academic smartphone use or the use of smartphones for learning purposes, the theory suggests that it can impact these factors in different ways and ultimately affect academic performance.

Firstly, smartphone use for learning purposes can impact time on instruction or task, which refers to the amount of time a student spends on a particular academic task. According to the theory, the more time a student spends on a task, the better their performance will be (Reynolds & Walberg, 1992). When students use smartphones for learning purposes, they can access educational resources such as online articles, textbooks, and educational apps that can increase their time on task and enhance their academic performance. However, it is important to note that excessive smartphone use, even for learning purposes, can also decrease time on task and negatively impact academic performance (Samaha & Hawi, 2016).

Secondly, the theory suggests that motivation is a critical factor that influences academic performance. Students who are motivated to learn tend to perform better academically (Reynolds & Walberg, 1992). Academic use of smartphones can increase motivation in students. For instance, students may be more engaged in their learning when they use educational apps, games, or videos on their smartphones (Annamalai et al., 2021). Additionally, students can collaborate with their peers or teachers through social media or other communication apps to discuss their coursework and increase their motivation to learn (Annamalai & Kumar, 2020).

Lastly, the quality of instruction is also a factor that influences academic performance according to the educational productivity theory. Smartphone use for learning purposes can improve the quality of instruction by providing students with access to a wide range of educational resources and technology that enhances learning (Ifeyanyi & Chukwuere, 2018). For instance, teachers can use smartphones to create multimedia content such as videos, presentations, or quizzes that can supplement classroom instruction and improve student engagement.

In summary, the theory supports that academic smartphone use affects academic performance. In this study, we identified recent research on academic smartphone use in different regions and summarised empirical studies to explore the impact of academic smartphone use on academic performance.

Methodology

This study employed the systematic review methodology with the use of PRISMA guidelines to identify relevant literature. Figure 1 illustrates the flowchart of the study process. Inclusion Criteria: The search was conducted in Scopus, Web of Science (WoS), and Education Resources Information Centre (ERIC) databases on the 26th of March, 2023. Searches in the Scopus and WoS databases were conducted using specific keywords, including “education*” OR “academic” AND “smartphone*” AND “performance” OR “achievement*” AND “university*” OR “college*”. To obtain a comprehensive range of papers from the ERIC database, we used a manual selection of papers related to higher education, rather than putting "university*" or "college*" in the search field. The search was limited to open-access journals and conference papers in the field of education published in English within the last five years (2018-2023).

The search yielded a total of 299 documents, with 256 from Web of Science, 14 from ERIC, and 29 from Scopus. In Scopus, a search string (TITLE-ABS-KEY (education* OR academic) AND TITLE-ABS-KEY (smartphone*) AND TITLE-ABS-KEY (performance) OR TITLE-ABS-KEY

(achievement*) AND TITLE-ABS-KEY (university*) OR TITLE-ABS-KEY (college*) AND (LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2023)) AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (DOCTYPE, "are") OR LIMIT-TO (DOCTYPE, "cp")) AND (LIMIT-TO (OA, "all")) was used to identify academic papers related to the study parameters.

During the screening phase, excel files with details about the paper, including title, author and abstract, were exported from the database. Six duplicated papers were deleted, and 29 papers from Scopus, 14 full-text papers from ERIC, and 250 documents from Web of Science were screened for eligibility based on title and abstract.

Exclusion Criteria: After careful assessment, out of 299 papers, 6 duplicated papers were deleted, 268 papers were excluded as they did not meet the inclusion criteria. Specifically, these papers focused on parameters such as primary, middle and high school students, smartphone addiction, Use of smartphones for recreational activities, smartphone use habits, and perceptions of smartphone use, which were beyond the scope of this study. Based on this phase, 5 papers from ERIC, 7 papers from Scopus, and 13 papers were selected for further review. After a careful reading of the findings, 17 articles that were not relevant to academic smartphone use were excluded. Finally, 8 were deemed eligible for full-text review, and these papers were included in the systematic review. The flow chart of the current review can be seen in Figure 1.

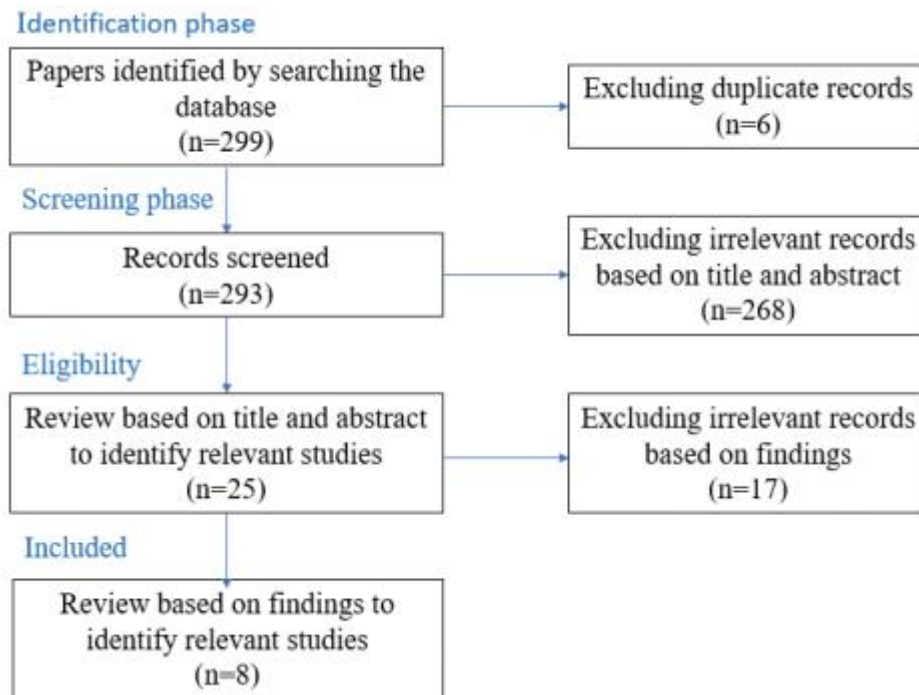


Figure 1. Flow chart process of the current review.

Results

Key Publications and Research Trends

To investigate the key publications and research trends in this particular field, a bibliometric analysis was conducted. The analysis included different aspects such as the yearly publication count, the number of different types of papers, publishers, research areas and authors' affiliations.

Figure 2 illustrates the distribution of the number of documents published annually, with 2 documents being published in 2018, 2 in 2019, 2 in 2020, 2 in 2021, 1 in 2022, and 0 in 2023.

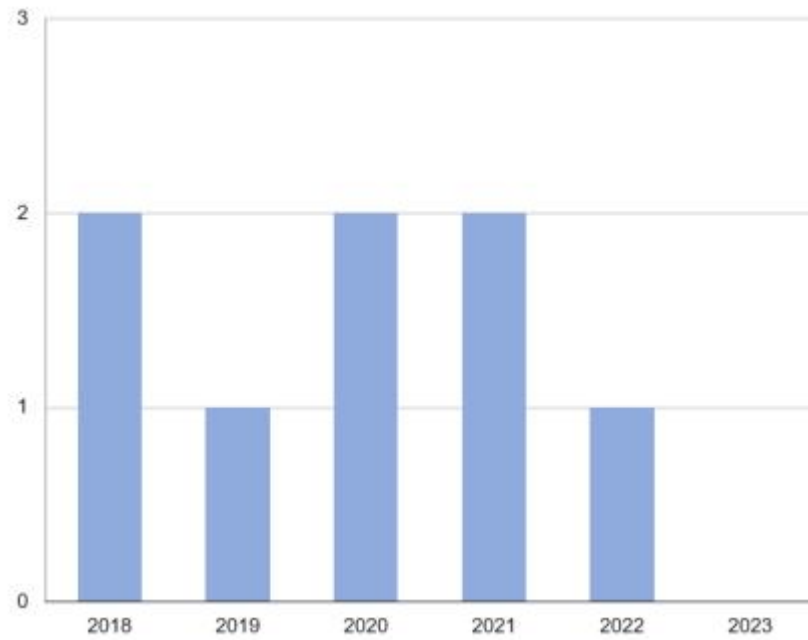


Figure 2. The number of documents published annually

This review covered 8 documents, comprising 7 journal articles and 1 conference paper. A summary of the relevant conference paper and journal articles is presented in Table 1. Articles are sorted by year. Among the identified documents, "IOP Publishing" published one conference paper in this field of interest, and other 7 different publishers published the remaining journal articles (1 article each). These studies were conducted in different countries such as China, the Czech Republic, India, Indonesia, Iran, Lithuania, Singapore and South Africa. It can be seen that most of the studies were conducted in Asia. For example, China is located in East Asia, India in South Asia, Iran in West Asia, and two in Southeast Asia, namely Singapore and Indonesia. The findings are graphically provided in Figure 3.

Table 1. A summary of the relevant conference paper and journal article

	Author	Type	Year	Publishers
1	Ifeanyi, I.P., & Chukwuere, J.E.	Journal	2018	Laboratory knowledge management & E-learning
2	Zhao, J., Yuping, W., Maideen, I., Moe, Z. K., & Nasirudeen, A. M. A	Journal	2018	i-manager Publications
3	Klimova, B	Journal	2019	MDPI
4	Akkara, S., Mallampalli, M., & Anumula, V	Journal	2020	International Association of Online Engineering
5	Andriani, R., & Kasriyati, D	Conference	2020	IOP Publishing
6	Annamalai, N., Mažeikienė, V., Tangiisuran, B., & Valūnaitė Oleškevičienė, G	Journal	2021	Universiti Utara Malaysia Press
7	Huang, H. W	Journal	2021	Australasian Society for Computers in Learning in Tertiary Education
8	Zakian, M., Xodabande, I., Valizadeh, M., & Yousefvand, M	Journal	2022	SpringerOpen

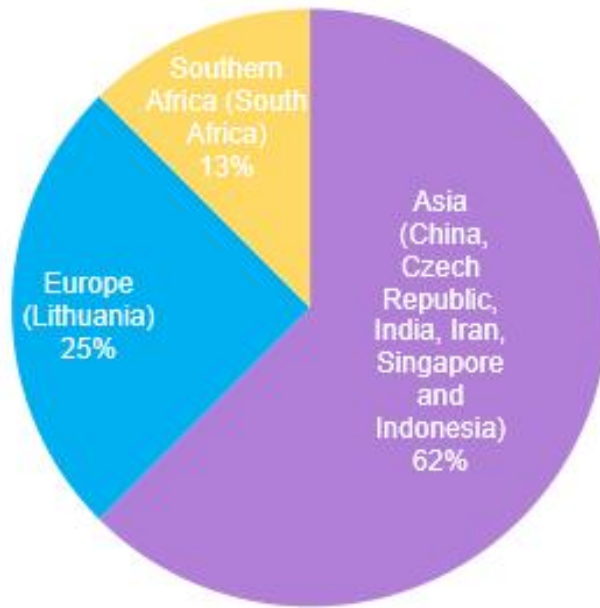


Figure 3. Contribution of different countries

In terms of author affiliations, 11 universities or institutions were identified from different countries. There are 9 universities and 2 institutions. The universities contain the Fujian University of Technology in China, the University of Science and Technology of Mazandaran and Kharazmi University in Iran, Cappadocia University in Turkey, Universitas Lancang Kuning in Indonesia, the University of Hradec Králové in the Czech Republic, Universiti Sains Malaysia in Malaysia, Mykolas Romeris University in Lithuania, and North-west University in Southern Africa. The institutions include the Hindustan Institute of Technology and Science in India and Ngee Ann Polytechnic in Singapore. Among universities and institutions, Universiti Sains Malaysia in Malaysia had the highest number of affiliations (2). The distribution of Author affiliations is presented in Figure 4.

The author affiliations are from different countries, and there are two more countries compared to the publishers' countries, namely Turkey and Malaysia. It is presented in Figure 5.



Figure 4. Contribution of Author affiliations



Figure 5. Affiliation appearance of the countries where the universities and institutions are located

Academic Use of Smartphones and Academic Performance

To explore the impact of academic use of smartphones on academic performance, this paper reports on the impact of academic smartphone use on academic achievement in terms of student use patterns, fields of use, the context of smartphone use, research methodology, and key findings. A summary of the literature can be seen in Table 2.

Recently, there has been an exploration of how smartphones can be used for learning and in what different ways they can help students in higher education. In this study, we categorized the smartphone use patterns addressed in these review articles into three categories, including the use of smartphone features, the use of educational apps, and the general use of learning activities. The classification revealed that more than half of the papers (6) emphasised the use of smartphone applications in academia, followed by the use of smartphone features (2), and general use for learning activities (2). Two articles mentioned both smartphone features and applications in learning, as can be seen in Figure 6.

Table 2. A summary of the literature

	Author	Year	Patterns	Field	Context	Size	Method	Key Findings
1	Ifeanyi, I.P., & Chukwuere, J.E.	2018	General	General	No specified	375	Cross-sectional	<ol style="list-style-type: none"> 1. More access to social networks (Facebook, WhatsApp). 2. For general use, distraction. For academic purposes: improve academic performance. 3. Increases collaborative activities, academic assistance, and information sharing.
2	Zhao, J., Yuping, W., Maideen, I., Moe, Z. K., & Nasirudeen, A. M. A	2018	General	General	No specified	619	Cross-sectional	<ol style="list-style-type: none"> 1. Significant positive correlation, higher GPA. 2. Female students use smartphones for learning more frequently 3. International students use smartphones for learning more frequently.
3	Klimova, B	2019	Applications	English	In the classroom and out of the classroom	33	Case study	<ol style="list-style-type: none"> 1. Significantly higher academic performance. 2. Personalized mobile apps increase students' learning efficiency. 3. Learning English vocabulary outside of the classroom through smartphone apps keeps students motivated.
4	Andriani, R., & Kasriyati, D	2020	Applications	English	In the classroom and out of the classroom	44	Action research	Using smartphone apps can improve English language learning, stimulate students' ideas and increase their enthusiasm for learning in and out of the classroom.
5	Akkara, S., Mallampalli, M., & Anumula, V	2020	Features and Applications	English	Out of the classroom	25	Mixed-method	<ol style="list-style-type: none"> 1. Significant improvement in English academic performance. 2. Easy to use, facilitate student engagement, provide a personalized learning experience.

	Author	Year	Patterns	Field	Context	Size	Method	Key Findings
6	Annamalai, N., Mažeikienė, V., Tangiisuran, B., & Valūnaitė Oleškevičienė, G	2021	Applications	General	In the classroom and out of the classroom	160	Mixed-method	Smartphone applications improve students' collaboration, interaction and improved their learning performance.
7	Huang, H. W	2021	Features and Applications	English	In the classroom and out of the classroom	65	Mixed-method	1. Significant improvement in English speaking proficiency. 2. Improve learning engagement and higher-order thinking skills. 3. Could be potential learning tools.
8	Zakian, M., Xodabande, I., Valizadeh, M., & Yousefvand, M	2022	Applications	English	Out of the classroom	86	Experiment	1. Significantly increasing the English vocabulary, increase motivation and improve learning outcomes. 2. In the long term, vocabulary still improved despite a decline midway 3. Positive attitudes. 4. Effective and enjoyable way for learning outside the classroom.

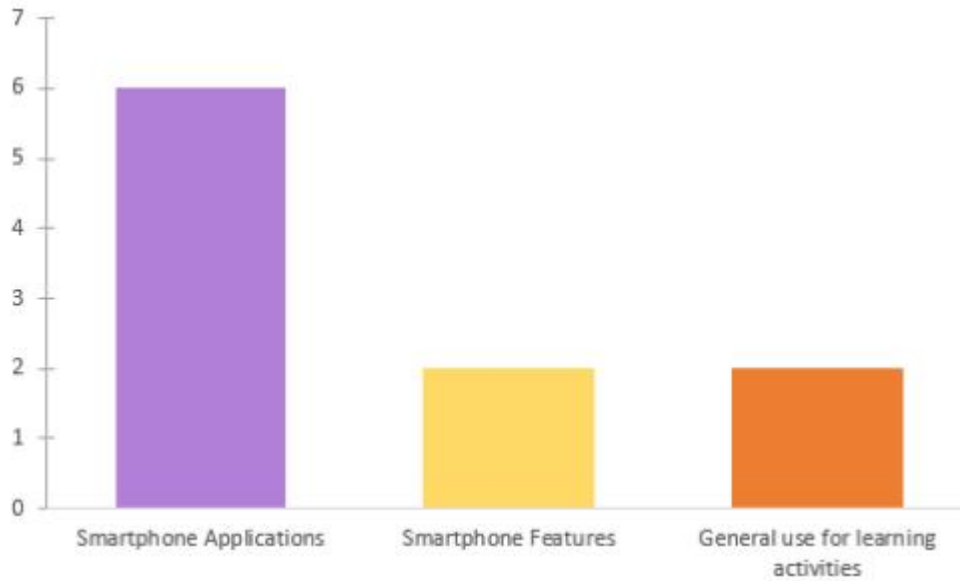


Figure 6. Classification of smartphone use patterns

Two articles focused on the general use of learning activities, mentioned the use of smartphone features and the use of smartphone apps and elaborated on students' use of smartphones to share course-related materials, contact peers and tutors for learning assistance, take photos of course-related documents, record and download lessons, and use educational apps and social networking sites for learning (Ifeanyi & Chukwuere, 2018; Zhao et al., 2018).

Surprisingly, we found that the majority of the articles on the use of smartphone apps focused on the area of English learning, five out of eight, while the remaining three did not mention the specific application area in question, but mainly focused on the use of any activity related to learning, as can be seen in Figure 7.



Figure 7. Fields of smartphone use

Regarding academic use of smartphones, four articles focused on both inside and outside the classroom, and most of them were studies on smartphone applications, only one of them included the use of smartphone features as well. Two articles focused only on the use of smartphones in learning outside the classroom, and interestingly they both focused on smartphone applications related to the field of English language learning, with one of them also mentioned the use of

smartphone features. The other two articles did not specify the context of smartphone use, which is because they emphasised the general use of smartphones in learning activities.

Discussion

Huang et al 2021 concluded that smartphones are used to access learning materials, communicate with peers and instructors, participate in online discussions, take quizzes and exams, and engage in other learning activities.

Academic performance refers to students' achievements in their academic pursuits. It can include grades gained in courses, performance on standardised tests, research projects, and other academic activities (Richardson et al., 2012). Academic performance can be influenced by a variety of factors, including a student's abilities, motivation, and external support systems such as access to educational resources and the quality of teaching (Reynolds & Walberg, 1992). Smartphones can provide easy access to educational resources such as e-books, online courses, and educational apps. With these resources readily available on their smartphones, students can supplement their learning outside of the classroom, which may facilitate their learning and affect their academic performance (Sung et al., 2016).

Students in higher education use various apps for interaction, with apps such as WhatsApp being the most popular (Annamalai et al., 2021; Ifeanyi & Chukwuere, 2018). Most papers explained how students use smartphone apps in academic-related tasks (Akkara et al., 2020; Andriani & Kasriyati, 2020; Annamalai et al., 2021; Huang, 2021; Klimova, 2019; Zakian et al., 2022), for example, smartphone apps are used by students to memorise English vocabulary, for pronunciation and speaking practice, and translation activities. Two papers mentioned how smartphone features are used in students' learning, for example, smartphones allow students to share information, record voice, and record and edit videos (Akkara, Mallampalli, & Anumula, 2020; Huang, 2021).

In terms of methodology, a total of 1407 students were involved in all studies. Three studies used mixed methods, two studies used quantitative studies with a cross-sectional research design, one chose an experimental method, and one chose a case study. Of the three mixed methods studies, all focused on the use of smartphone apps, and two of them also included studies on smartphone features. In addition, two of them focused on the area of English language learning and the other one was used for general learning. In the quantitative survey studies, they focused on the use of smartphones in learning activities in general, rather than on domain-specific studies. The remaining experimental studies and case studies were used to examine specific apps that help students learn English. Different types of methods were used to meet the different purposes of the study.

When it comes to the findings of these papers, all of the studies show that academic smartphone use can significantly improve academic performance in terms of grades, student motivation, collaborative performance, learning effectiveness, and engagement in learning. Three studies highlighted the important impact of smartphone use on learning in terms of stimulating student motivation (Klimova, 2019; Andriani & Kasriyati, 2020; Zakian et al., 2022). In addition, two studies show that smartphones can increase academic assistance in learning and improve collaboration and interaction (Ifeanyi & Chukwuere, 2018; Annamalai et al., 2021). In addition, two papers highlighted increased student engagement in learning and two articles suggested that personalised mobile apps can be an effective educational learning tool. Furthermore, two studies showed that students use social networks more often, especially WhatsApp. In addition, Zhao et al. (2018) mentioned that female students use smartphones for learning more than male students and that international students use smartphones for learning more than local students. Also, in one study, positive attitudes were found towards the use of smartphone-assisted learning apps. A summary of the results of these studies can be seen in Figure 8.

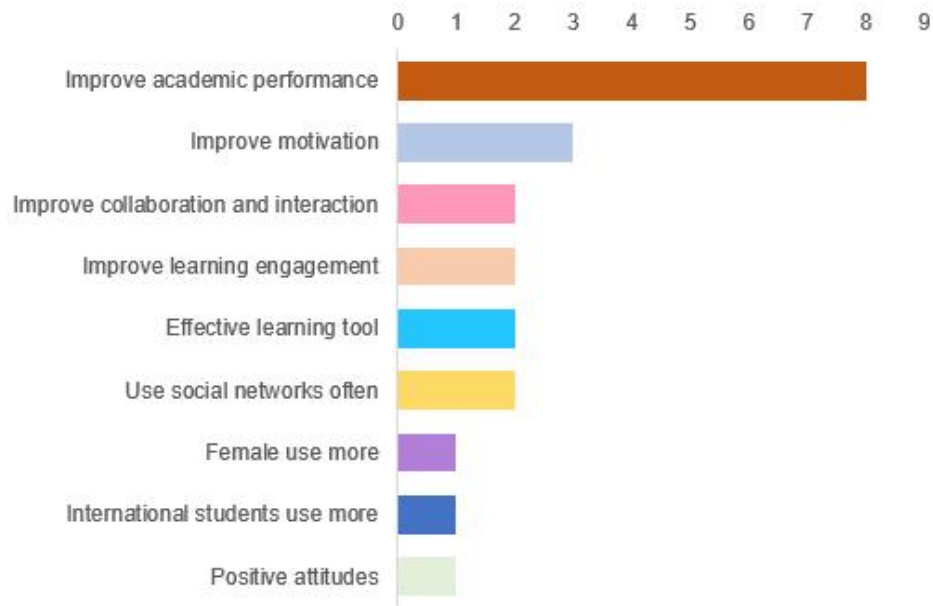


Figure 8. A summary of the key results

Conclusion

Smartphone use has a significant positive impact on academic performance. It also motivates students, increases student collaboration, and interaction, and increases their engagement in learning in the classroom or outside of class. Personalised smartphone apps can be an effective learning tool. Also, the study found positive student attitudes toward the use of smartphone-assisted learning apps. The findings also pointed to the most frequent use of social networks by students. These warrants drawing educators' attention to how students are properly using social networks in relation to learning. The results of this study will help educators gain insight into the potential impact of academic smartphone use on learning outcomes and develop strategies to help students optimize their academic use of smartphones to improve academic performance and reduce the negative impact of smartphone use on learning outcomes.

Limitation

This study has some limitations and the data collection could have included additional databases for more comprehensive data, such as using Google Scholar. This study focused only on academic smartphone use or the use of smartphones for learning purposes; however, it may not show the full picture of smartphone use in learning environments.

Future Recommendation

Future research could include any smartphone use that affects student learning, such as including habits and behaviours of smartphone use that affect student learning. The role of smartphones in higher education is still an evolving area of research, and more studies are needed to fully understand their effects on learning outcomes.

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