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Mobile phones as an effective learning resource: Science teachers' perspectives

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ABSTRACT

This study aimed to find out the perspectives of science teachers on the effectiveness of using mobile in learning and education. Technological development in all areas of life has made an impact on the development of the educational process, through the invention of devices such as cell phones which had a share of this development. These devices were developed to support programs and applications that help in the education and teaching process. The current study used the analytical descriptive approach applied to a group of 150 male and female teachers in secondary schools in Al Dakhiliyah Governorate in Oman. Interviews were conducted with all 150 participants by asking specific questions in order to be classified and analyzed in a scientific way that helped to understand teachers' perspectives in the context and compared to previous literature. The findings revealed the positive impact of using the cell phone in learning and its effectiveness in improving and developing the educational process despite challenges. Cell phones have proved their effectiveness in facilitating the learning process as the results of this study showed that they encouraged science teachers and motivated them to use cell phones in their lessons

Contribution/Originality: This research pioneers the use of cell phones in learning and education in Jordanians from the perspectives of science teachers. It shows how mobile phones can make a positive impact on learning and prove effective in improving the educational process.

1. INTRODUCTION

Modern societies are experiencing a tremendous expansion of technology in all fields, including education. In keeping with this trend, information, and communication technology are being used increasingly in educational activities as a teaching and learning aid. Academic institutions, like learning organizations, emphasize using advanced technologies to improve progress, particularly in teaching and learning (Matimbwa & Anney, 2016). The term "mobile learning" (or "m-learning") refers to the use of cell phone technologies in education since the use of smartphones offering both educators and learners a wide range of opportunities to use them to assist learning activities and the potential for successful teaching and learning due to its ubiquity and easy accessibility. One of the benefits of using mobile learning is the availability to interchange information without needing a specific place and time, facilitating the development of critical thinking, problem-solving, and lifetime communication skills (Abidin & Tho, 2018; İlçi, 2014). However, m-learning can never completely replace traditional education, despite the advantages, but when used properly, it can boost the value of current learning methods (Liaw, Hatala, & Huang, 2010).

The use of cell phone for education has been increasingly popular around the world. Many groups, particularly teachers and students, utilize this device to share knowledge and dictionaries and thesaurus. Cell phones have been presented as one of the applications for both teaching and learning, in which they are presented as a brand-new possibility for the use of ICT in education (Lepp, Barkley, & Karpinski, 2015). The term ICT, which is the short form of Information and Communications Technology, denotes all communication devices that allow users to communicate and access information anytime and anywhere. M-learning, like other forms of learning, encourages cooperation among students and instructors and, as a result, learning by mobile can give instant tips and feedback (Alnuaim, Caleb-Solly, & Perry, 2009). M-learning is the next big revolution in mobile technology and it will thrive and outdo E-learning in the future. The capabilities of devices such as cell phones, tablets, laptops are gradually rising, thereby further increasing the development of M-learning technology due to rapid growth in mobile technology and the transformation of mobile phones into smartphones (Keskin & Metcalf, 2011). Until recently, it was common to experience some problems like the need for a cable to access a web-based learning environment, nondurable batteries, and trouble connecting to the internet. Consequently, it was nearly impossible to establish the ideal free environment for learning. This problem has been solved with the emergence of smartphones with their improved hardware, long-lasting batteries, and simple internet access (Göksu & Atici, 2013). Applications for mobile learning are a new breed of information systems that offer various educational services, including the ability to download and upload learning materials, turn in assignments, and view the information provided by teachers. It also helps teachers to present good learning content and update needed information to learners, and open new channels for interaction between teachers and learners. Therefore, universities must provide distinctive services and high-quality mobile applications to achieve high-quality mobile learning and education services (Almaiah, Alamri, & Al-Rahmi, 2019).

Mobile learning in the education process must have features that provide more benefits such as flexibility, ease, adaptability, accessibility, multimedia, dialogue, visibility, and others (Prieto, Migueláñez, & García-Peñalvo, 2014). An example of a study conducted in 2011 in this area is the MENTOR ME program, which was applied at Barnet College (North London). This program supported all students and mentors with email-enabled mobile phones for convenience. This made situated learning possible despite the limited time accessible to mentors and trainee teachers. Face-to-face meetings were partly replaced by using the cell phone functionality to record students' official and informal learning. To further enhance the mentoring and teaching experience, this program was also used to discuss with peers, tutors, mentors, and session observers. Self-reflection, group evaluation, peer support, and idea sharing helped trainees practice more effectively and become more employable. The initiative was successful in improving university education and raising students' awareness of these devices' advantages and the organization adopted mobile learning across the curriculum as a result of the project's success (Cushing, 2011).

Currently, with the development of technology most students possess cell phones with all smoothness to use them in the field of education. It helps to educate the next generation in all areas of life and develops society. This requires subject experts and experienced teachers to make a double effort and know how to deal with mobile phone platforms for educational goals and enhance educational learning. In this study, we seek to know the perspective of science teachers to use mobile learning and its effectiveness in education.

1.1. Research Problem

In the light of the development of different technologies in the field of education and by redefining learning process with the use cell phones, educational institutions seek to meet the requirements of the labor market in various disciplines to improve the education process. This study aimed to examine the extent to which the use of cell phones in the education field and learning process, especially in science subjects, helped to achieve these requirements.

1.2. Research Questions

Through a researcher's survey and interviews with a group of science teachers about the use of cell phone in the field of education, the following research questions were framed, to address the research problem:

- RQ1: What is the effect of using cell phone for learning on the attitudes of youth toward science education?
- RQ2: Which cell phone applications can serve educational institutions?
- RQ3: Is learning by cell phone help to positive changes in the educational process?
- RQ4: What are the challenges facing the learning by cell phone?
- RQ5: What are the benefits of using cell phones and its impact on life and education

1.3. Research Significance

There are advantages of using cell phone in the education process which helps to exchange information inside or outside the classroom faster if compared to traditional methods and it has no limitations on time or place. The small size of cell phone helps to be easily used and kept in a bag or pocket. Additionally, the cell phone has the capacity to save a lot of notes and E-Books and the possibility to perform teamwork tasks using Wi-Fi and Bluetooth.

1.4. Research Objectives

- To examine the importance of using cell phone in education.
- To understand the importance of cell phone applications to use in learning.
- To examine the impact of using cell phone in education field.

1.5. Research Terms

- Mobile Learning (M-Learning): Defined by Gomez as 'Mobile-dependent learning' which provides students with information free from spatial and temporal restrictions (Gómez, Zervas, Sampson, & Fabregat, 2014).
- Cell Phone Application or mobile app is known as a software program that runs on cell phone, tablets and smartwatches The exist a huge number of applications such as social media, life style, news mobile app…etc. to help users take advantage of cell phone networks in a fast time and simple way. Android and ISO are the most operating system in cell phones (Mobile App, 2023)

1.6. Research Limits

Spatial limits: Ad Dakhiliyah Governorate, Nizwa town, Oman.

Human limits: Secondary school science teachers in Ad Dakhiliyah Governorate (Nizwa town) in Oman.

Time limits: 1st semester of the academic year 2021-2022.

2. THEORETICAL FRAMEWORK

2.1. Cell phone Definition

A mobile device or cellphone is in general terms a handheld computer or smartphone and it is a portable device for calling or receiving calls. Mobile devices include tablets, e-readers, smartphones, smartwatches, and like. The smartphone was introduced by the IBM company in 1994. and then developed by Apple and Samsung companies to service using a cellular network. Smartphones are mobile phones with significantly more advanced processing capabilities than feature phones

2.1.1 Cell Phone Functions

The function of cell phones in education and learning can be summarized as management, and organization such as courses, assignments, or others that are needed for students. It includes reminders to students about the

time for the course or training, assignments time, and so on. It enables communication between teachers and students, or between teachers and parents through video calls, email, or messages. It facilitates discussion about the lesson, viewpoints, and others. It also downloads documents, letters, lectures, or other programs that are useful for education (Alden, 2013; Weichbroth, 2020).

2.2. Benefits of using Cell Phone for learning

2.2.1. Benefits of using Cell Phone for learning from the Student Viewpoint

Students can enhance their learning performance, learning process, and learning experience by using *cell phone*, which has several advantages. Students who use *mobile* devices perform better academically and are more motivated to learn than other students (Jou, Lin, & Wu, 2016). According to a study done at the University of Belgrade's Faculty of Organizational Sciences, using *mobile* devices for learning increased students' desire to learn (Bogdanović, Barać, Jovanić, Popović, & Radenković, 2014). Similar results were obtained from a study performed at the University of Leeds, which showed that using cell phone for learning increased students' performance on multiple-choice questions related to learning neuroanatomy (Morris, Lambe, Ciccone, & Swinnerton, 2016). Mobile devices help students learn from one another and encourage closer collaboration during in-class tasks. This is so that every student can participate in class events using their mobile devices, thanks to mobile devices that help all of the students can rapidly share their remarks with their colleagues, which improved the effectiveness of the discussion (Reychav & McHaney, 2017).

2.2.2. Benefits of Cell Phone for Learning from the Teacher's Viewpoint

The majority of the advantages pertain to how cell phone can assist teachers in enhancing the academic performance of their students. For instance, it helps teachers get students interested in and motivated to learn (Claro, Nussbaum, López, & Contardo, 2017) establishing a range of environments for learning and promoting information sharing in the classroom. Therefore, cell phone help to enhance the quality of teaching and education and helps both teachers and students.

2.3. Challenges of Using Cell Phone for learning

They are many different challenges that students and teachers face when using cell phones for learning. Mobile devices can be an enormous distraction and cell phones can be distracting if your user constantly gets interrupted by text messages and notifications (Pedro, Santos, Aresta, & Almeida, 2015). Therefore, we try to elucidate some of these challenges. Most challenges can be divided into three groups: first group: some challenges because of students themselves. This is because of don't have the ability to use cell phones in the classroom, or due to the behavior of students and their lack of discipline at the time of the lesson, and others. Second group: the challenges due to teachers themself due to the workload of teachers, the teaching process, old teachers may not know how to handle it in the classroom, and others. The third one is challenging due to mobile systems, operations, and others (Chun, 2019).

3. RESEARCH METHODOLOGY

3.1. Research Design

The researcher used the analytical descriptive approach for it being appropriate for the nature of the study which aims to examine the effectiveness of using cell phone for learning science subjects and know the opinion of science teachers to use cell phone devices in education

3.2. Research Population and Sample

The study population consisted of all science teachers in Ad Dakhiliyah Governorate (Nizwa town) in Oman.

The study sample comprised 150 secondary school science teachers in Ad Dakhiliyah Governorate (Nizwa town) in Oman.

Table 1. The characteristics of the study sample according to its variables.

Variable	Category	Frequency	Years of experience	Percentage %
Gender	Male	85	5 -15 years	56.7%
	Female	65	5 -15 years	43.3%
Total	150			

Table 1 presents the characteristics of the study sample according to the variable of gender. It shows that the sample included 85 males and 65 females. Their experience ranged between 5 and 15 years.

3.3. Research Tool, Validity, and Reliability

Research questions were developed and designed based on existing literature on using mobile devices. The interviews were conducted in Ad Dakhiliyah Governorate with secondary school science teachers. The interview method is one of the qualitative research methods that are used to find out data and information obtained from a study sample (Herlina & Santoso, 2022). In this work, we used both qualitative and quantitative methods to obtain accurate results and to interpret and compare results of other studies in the same direction. Before starting the interview, all informants were briefed about the purpose of the research and that the data collected would be used only for academic purposes. After collecting the demographic details such as gender and years of experience, the questions related to cell phones used for education were asked and 30 minutes we needed for each participant. Each interview was recorded and transcribed to ensure no missing any information which helped to facilitate sorting and analyzed the answers.

The validity of the questions of the interview was verified by a number of expert and specialist teachers related to the field of the study, and the questions of the interview were modified according to their suggestions and recommendations. Furthermore, the reliability of the interview questions was verified on a survey sample similar to the sample of our study and the results showed the reliability and appropriate to the objectives of the current study.

3.4. Data Analysis

By conducting interviews with the target group and asking them questions. Their answers were analyzed and then classified into thematic groups.

Inferences were arrived at based on the responses obtained from the interview informants. This helped in preparing categories and conducting a thematic analysis to identify the underlying themes. For each question, three thematic groups were made (Group A, Group B, and Group C). Each theme is divided from strongly disagree to strongly agree (1-5) to ease identify, interpret, and tabulate. The variation among the groups was shown through percentage.

4. RESULTS AND DISCUSSION

4.1. Results

The responses to the first research question "What is the effect of using cell phone for learning on the attitudes of youth toward science education?". were divided into three categories based on the themes that were retrieved as shown in Figure 1.

Theme A: I think using cell phone in the educational process will positively affect science education.

Theme B: I think cell phone cannot achieve the goals of science education.

Theme C: I think science education learning needs laboratories and practical application, which cannot be achieved through a cell phone -only.

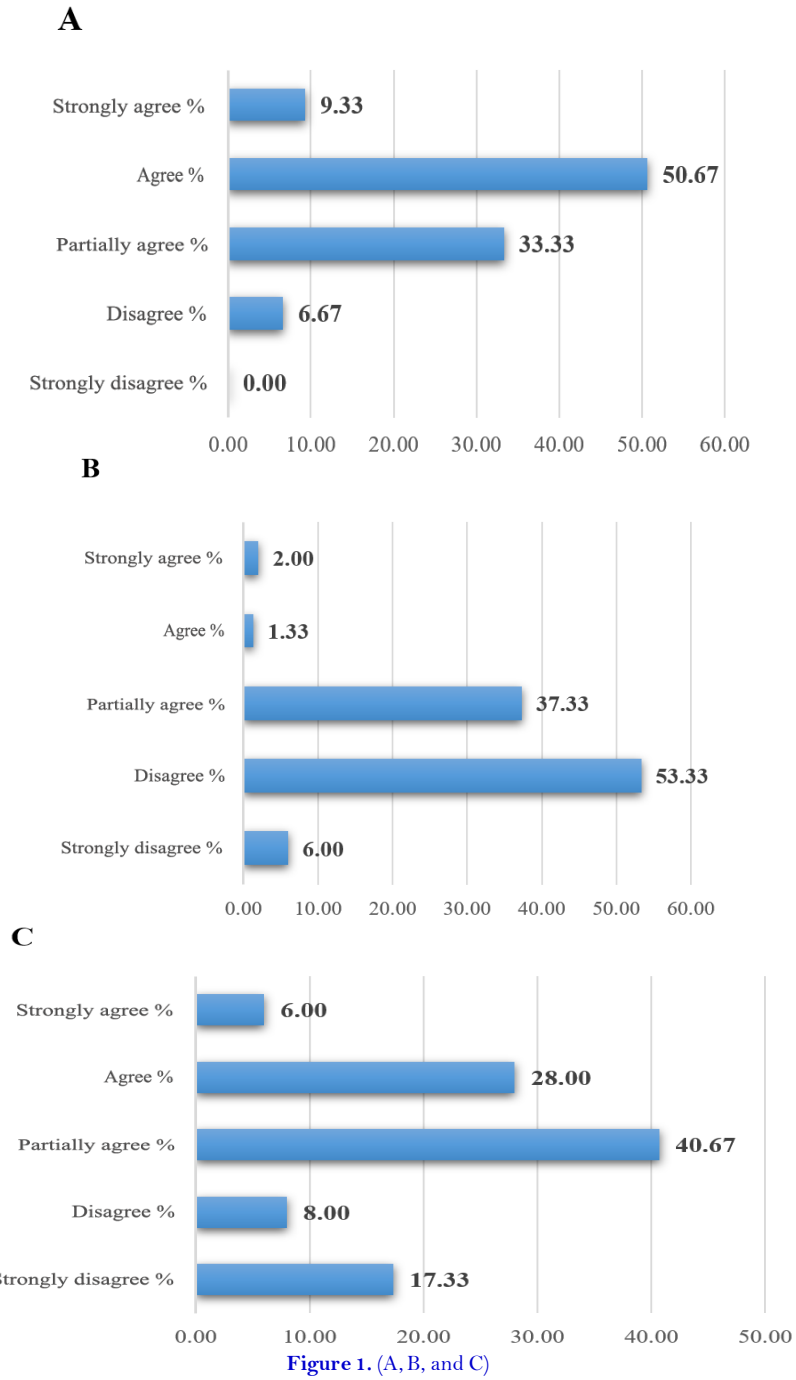

Figure 1. (A, B, and C)

Results related to 2nd question: Which cell phone applications can serve educational institutions? Obtained results were divided into three categories based on the themes that were retrieved as shown in Figure 2.

Theme A: Cell phone apps to my knowledge are Teams and Zoom.

Theme B: Some of the best applications of cell phone used in education are Google Meet and Google Classroom.

Theme C: Online there are some of cell phone applications used for teaching scientific subjects, the teacher can be used them.

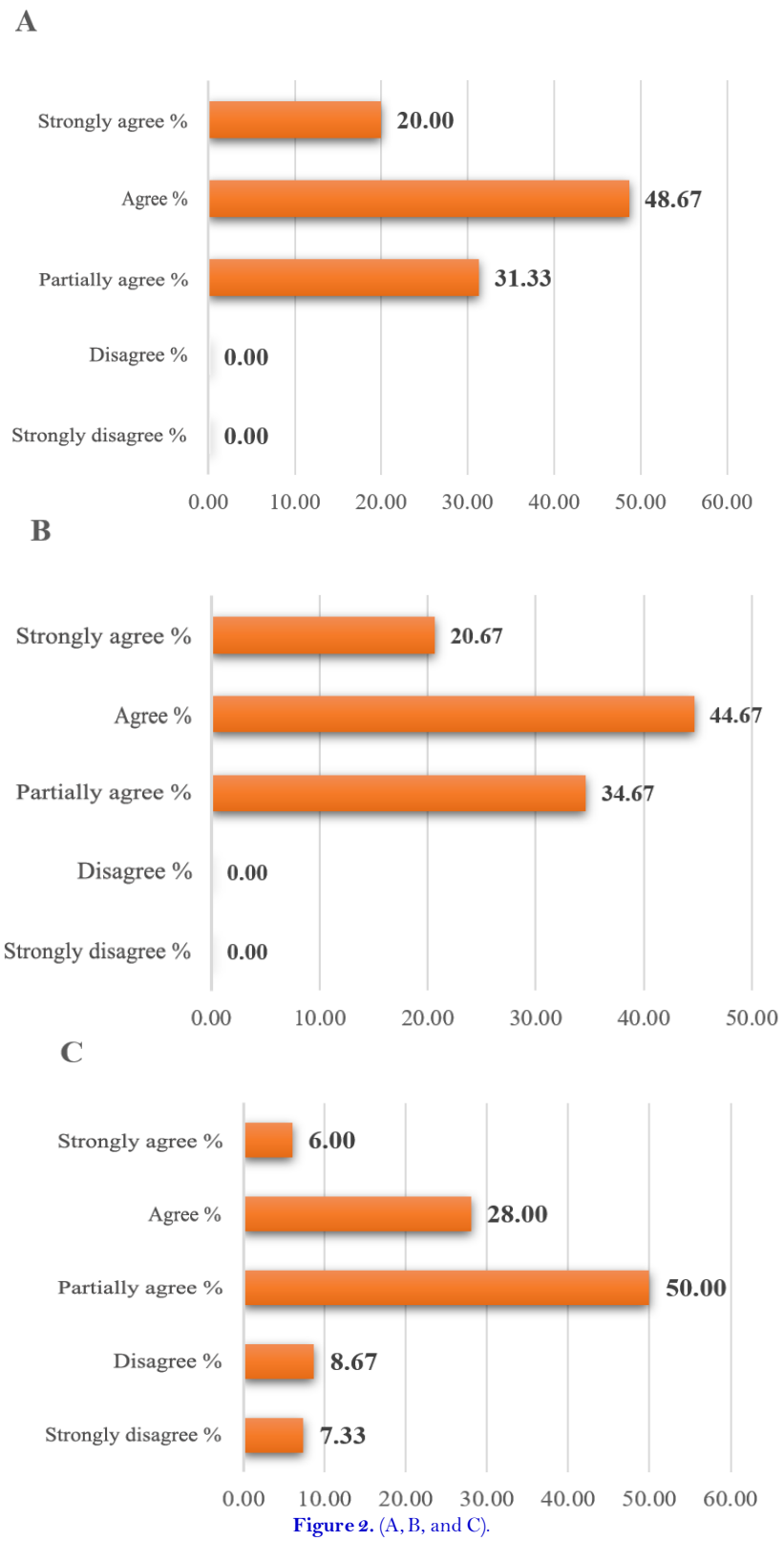

Figure 2. (A, B, and C).

Results related to 3rd question: Is learning by cell phone help to positive changes in the educational process? The results were displayed in Figures 3 A, B, and C.

Theme A: If the appropriate structure is available, positive results can be achieved in the educational process.

Theme B: In light of the reality, we live in, I do not think it will have positive results.

Theme C: Positive results can be achieved by both the student and the teacher

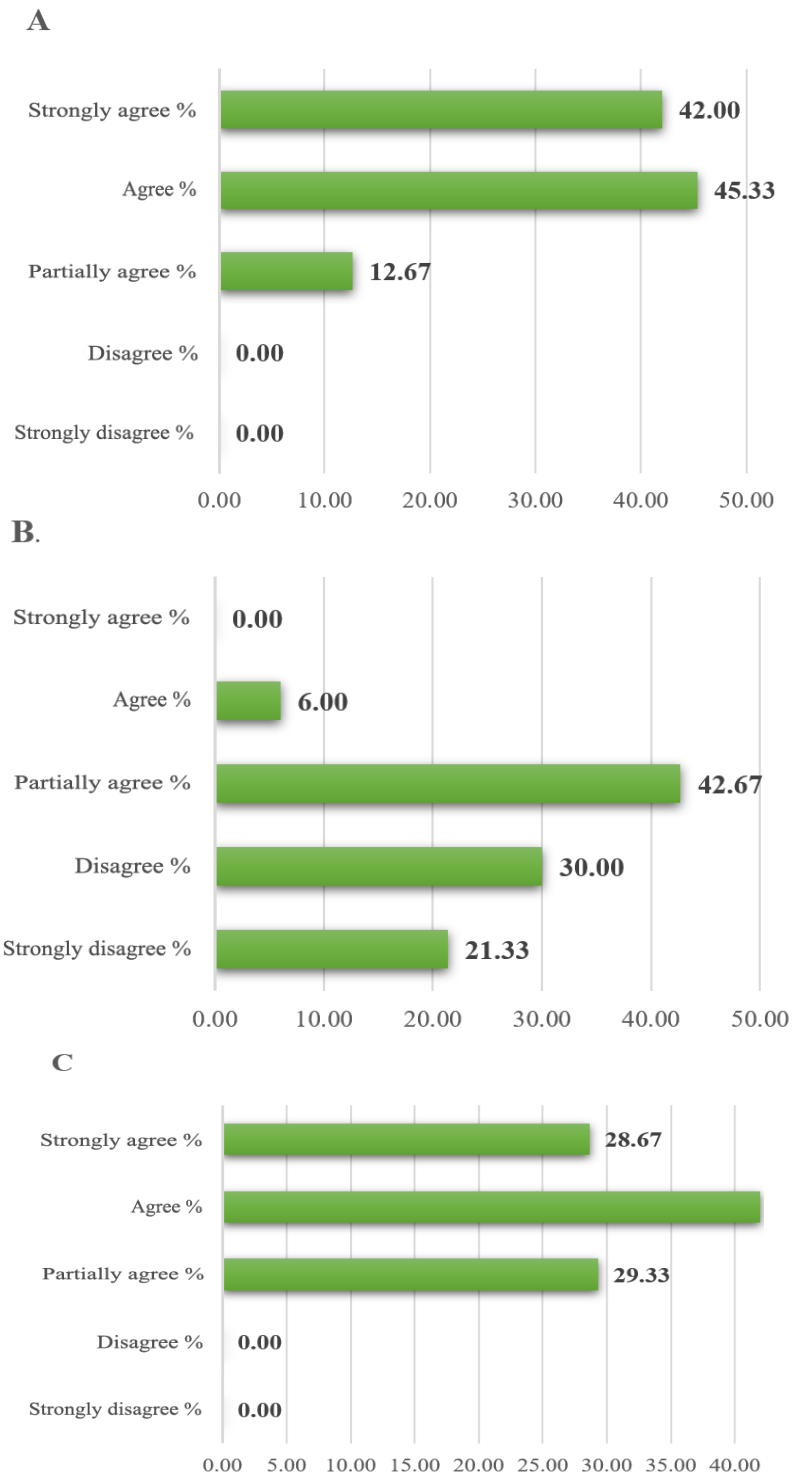

Figure 3. (A, B, and C).

Result related to 4th question: What are the challenges facing learning by cell phone? The results were displayed in Figures 4 A, B, and C.

Theme A: I think the most critical challenge is the availability of good networks for using the internet and modern cell phones.

Theme B: I think the most important challenge is controlling students' Internet use and not accessing prohibited sites during the education process.

Theme **C:** I think the most important challenge is the power of the Internet and its availability to all students easily and at no cost.

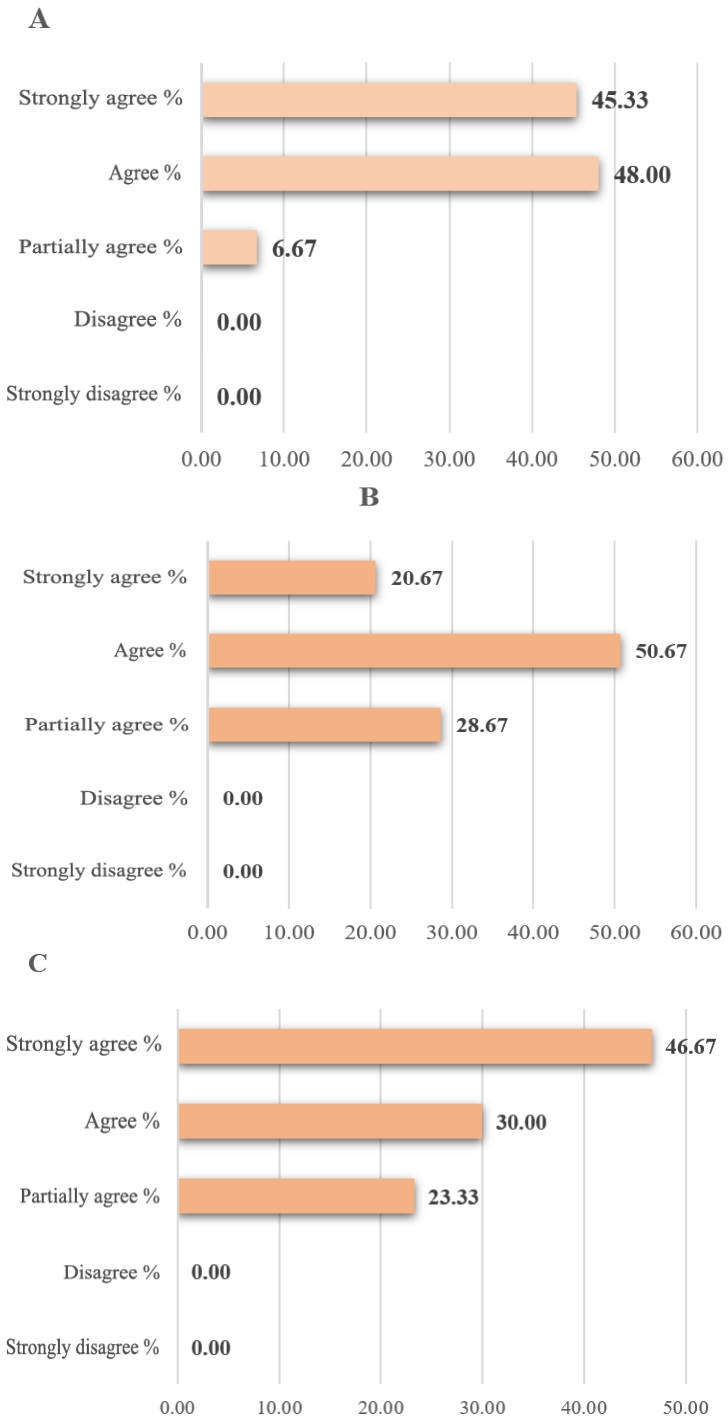

Figure 4. (A, B, and C).

Result related to 5th question: What are the benefits of using cell phones and their impact on life and education? The results also were divided into three parts as shown in Figure 5.

Theme A: Cell phone has become an essential component of the educational process.

Theme B: Science is linked to the use of cell phones, and the objectives of science are achieved by integrating it with sciences and society.

Theme C: The development of cell phones become rapidly and has become essential in people's lives, helping them to access information quickly and easily.

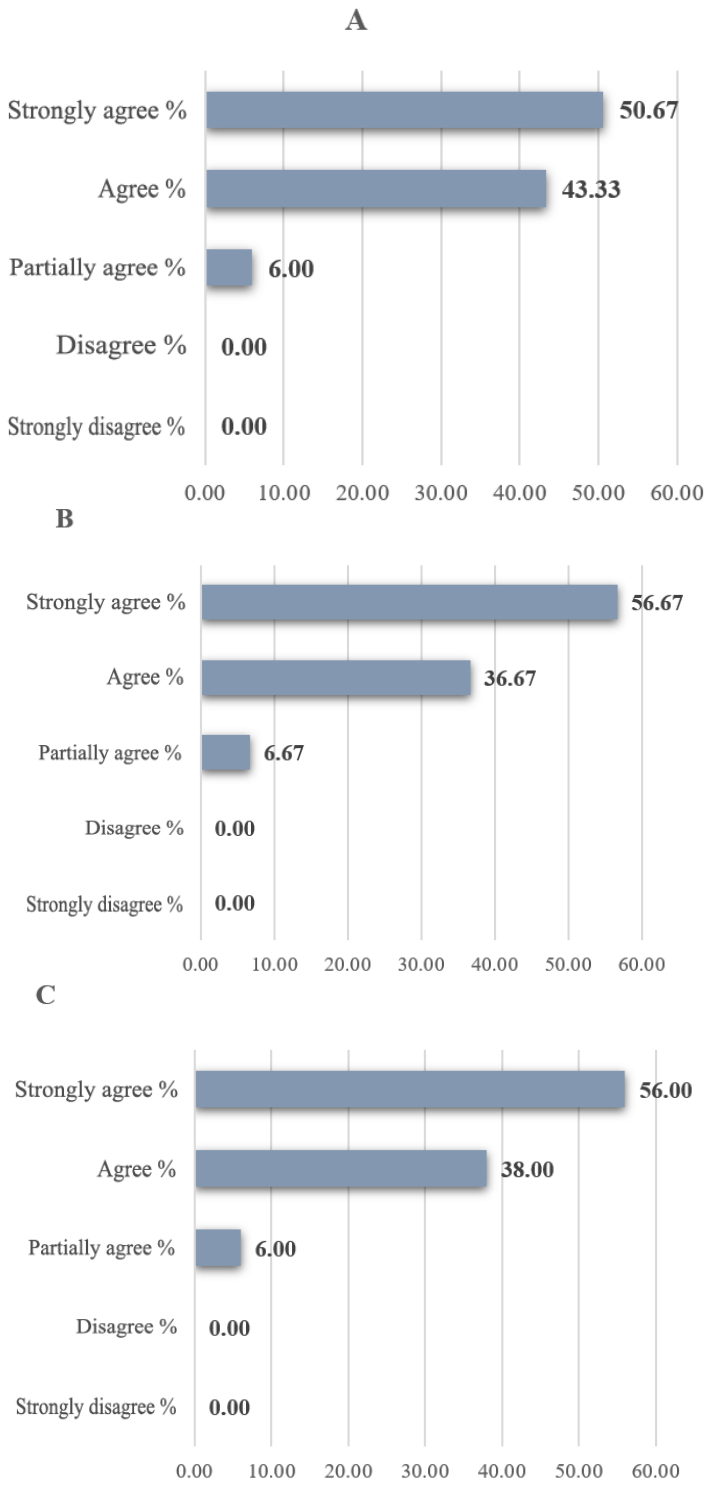

Figure 5. (A, B, and C).

4.2. Discussion

From the obtained result, the study found that Science teachers have a positive attitude toward the use of cell phones in the teaching and learning process, similar to other works done by researchers (Attard, 2017; Kyriakides, Meletiou-Mavrotheris, & Prodromou, 2016; Abidin & Tho, 2018; Sanga, Mlozi, Haug, & Tumbo, 2016). They also had the knowledge about some programs which help to improve education process by using cell phones and smart mobiles such as Team, Zoom, Google Meet, and Google Classroom programs. As for their knowledge of other online programs that may help in the education process, some teachers have information about online programs due

to their keeping informed and continuously searching while some teachers have superficial information for that. These results agree with Herlina and Santoso (2022) who found that Google Classroom is one of the cell phone applications that can be used for learning and education (Herlina & Santoso, 2022).

From results, it was found that the teachers can possibly set up some virtual experiences that may help in understanding the students' scientific subject which is supported by González et al. (2017) who found the possibility to perform some experiments with the help of cell phones and smart mobiles which opens new ways to do experiments with low cost, also, Martín-Gutiérrez, Mora, Añorbe-Díaz, and González-Marrero (2017) reach in their results possibility of using cell phones in learning and the potential to use it in applying virtual experiments which help to understand some scientific concepts (Martín-Gutiérrez et al., 2017). Other teachers objected to the difficult to use the cell phone in setting up scientific experiments on which scientific subjects are based because most scientific experiments require actual laboratories to be conducted as explained.

The teaches agreed that it is possible to benefit positively from education and learning using a cell phones and smart mobiles if the appropriate environment available. This also can be achieved appropriately with the help of both teachers and students. Many studies that coincide with this result and show the effectiveness of using smart mobiles in learning and teaching and help teachers in education, summarized in the review and studies (García-Martínez, Fernández-Batanero, Cobos Sanchiz, & Luque De La Rosa, 2019; Kalogiannakis & Papadakis, 2019; Abidin & Tho, 2018; Sanga, Mlozi, Haug, & Tumbo, 2016). As well, Al-Mashhadani's study showed that. the positive role of using cell phones in the effectiveness and enhanced learning process in each of the universities and colleges under study (Al-Mashhadani & Al-Rawe, 2018) which is in agreement with our results. In the same way and coincide with our results Sanga and co-workers and Abidin and his groups found that learning by cell phones and smart mobile have the potential effect to improve and enhance the teaching and education process (Abidin & Tho, 2018; Sanga, Mlozi, Haug, & Tumbo, 2016).

There are some challenges of using cell phones in education include good availability of the Internet and the availability of modern devices that support the use of necessary applications of smart mobiles for the education process. A study conducted by Kaliisa and Picard (2017) explained that one of the most important challenges facing cell phones when used for learning, especially in higher education in Africa is the infrastructure technology and lack of modern phones that help in the education process which supported these opinions of sciences teachers (Kaliisa & Picard, 2017). Other teachers also explained that the availability of Internet access for all students and the possibility of accessing it easily at the lowest cost are some of the difficulties that face teaching by using cell phones. These results are consistent with a study conducted by Akpan with several challenges that may face the teacher during the performance of the educational process. He recommends the necessity of guidance of students by their teachers or parents in the correct ways to use mobile in education and to stay away from harmful or non-targeted sites (Akpan, 2017).

5. CONCLUSION

Learning and education using cell phones have become necessary in some cases to keep pace with technological development. Learning by cell phones has an effective role in improving the process of education, as indicated by science teachers in this investigation. Cell phone learning is of great importance, whether in schools or universities, and it has a positive effect on education and motivates the student to participate in the learning process, which was previously based on teachers-only. Nowadays, teachers encourage education with the help of smartphones (cell phones, tablets, etc.) because of their positive and encouraging results in motivating students towards education and opening new horizons for them to learning.

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Institutional Review Board Statement: The Ethical Committee of the AL- Hussein Bin Talal University, Jordan has granted approval for this study on 20 September 2022 (Ref. No. R9/22).
Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

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