Exploring Students' Perspectives on the Implementation of a Self-Organised Learning Environment:
SOLE via Mobile Devices

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ABSTRACT

This critical participatory action research explored undergraduate female Saudi students' perspectives on the implications of a self-organised learning environment (SOLE) via their mobile devices. Data was gathered from interviews and focus groups using a convenience sample of 27 undergraduate students and the researcher's reflective journals. The proposed intervention gave students opportunities for engagement and enhanced a spirit of cooperation, which led to the students enjoying their classes. Furthermore, SOLE encouraged the students to evaluate their ideas before posting them. Participating in SOLE helped the students to understand and recall the relevant course content. However, some challenging aspects, e.g., misleading information, emerged during the study's first phase, along with some technical issues.

KEYWORDS

Covid-19, Educational Technology, Innovative Teaching, Mobile Learning, Self-Organised Learning Environment (SOLE), Undergraduate Study Strategies

INTRODUCTION

Covid-19 and social distancing impacted education, which resulted in an unprecedented transition to online learning (Cahapay, 2020; Murphy, 2020; Teräs et al., 2020; Neuwirth et al., 2021). During the Covid crisis, educational institutions worldwide had to utilize the available platforms for e-learning to mitigate the spread of the virus (Maatuk et al., 2022). This abruptly emerging transition was referred to as '"emergency remote teaching" instead of "online learning" (Hodges et al., 2020). The primary aim in such circumstances was to ensure prompt and reliable access to instructional support during the crisis rather than focusing on creating a robust educational environment (Hodges et al., 2020). The sudden online transition posed various challenges, as was emphasized by teachers and students

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(Hafeez et al., 2021). Some of these challenges were attributed to technical issues such as inadequate internet connectivity (Lockee, 2021). Additional challenges arose regarding instructional strategies due to limited budgets and insufficiently skilled staff, hindering the implementation of active learning (Hafeez et al., 2021).

Globally, this situation was temporary; for example, universities in Saudi Arabia reopened in 2021. However, Covid-19 restrictions created limitations in the classroom, such as physical distancing and restricted sharing of educational materials, to protect the learners' health and prevent the spread of the disease. These measures hindered collaborative tasks and active learning for in-person university students. Furthermore, after months of pandemic isolation, students were hesitant to interact with others. Therefore, innovative teaching strategies were urgently needed to overcome these challenges and promote active student engagement.

As a solution, this research proposes an innovative method to implement a self-organized learning environment (SOLE) using mobile applications (apps) to support active learning and to enhance student engagement during the unusual circumstances of Covid-19 restrictions in university classrooms. SOLE is known as an innovative pedagogy in which the students can choose their group and solve problems with minimal intervention from the educator.

This study aims in particular to explore Saudi third-year undergraduate female students' perspectives on the SOLE pedagogical approach through mobile devices during in-person learning with Covid-19 restrictions. The study addresses a main research question (RQ1) and two sub-questions (SQ1 and SQ2):

RQ1: What are undergraduate students' perspectives on the implementation of the SOLE pedagogical approach via the use of mobile apps?
SQ1: What are undergraduate students' perspectives on the positive aspects of the implementation of the SOLE pedagogical approach via the use of mobile apps?
SQ2: What are the undergraduate students' perspectives on the negative aspects of the implementation of the SOLE pedagogical approach via the use of mobile apps?

RELATED WORK

What is SOLE?

SOLE is a modern pedagogy that promotes the cultivation of 21st-century skills in students (Weisblat et al., 2019). Originating from Mitra's "hole in the wall" concept, this innovative approach seeks to tackle educational challenges in regions with restricted teacher availability and appropriate learning environments (Mitra et al., 2005, p. 407). Mitra initially introduced the idea, in which children independently access a public computer to search for information and learn flexibly, with or without a mediator.

The study by Weisblat et al. (2019, p. 66) reports:

SOLE is an innovative pedagogical technique that disrupts the traditional didactic, teacher-centered classroom and provides a framework for a student-centered approach to learning. With this approach, teachers and students become co-navigators in a classroom practice.

Mitra identified three stages in the SOLE approach (see Fig. 1), which are: first, students are given a big question to think about, which leads them to pose more related questions; second, the students choose their group to investigate and to answer the big question; and, finally, each group presents and reviews their answers (StartSOLE, 2016).

Curiosity is the key to learning within this approach (Ma, 2018; Preston et al., 2018); therefore, Mitra emphasized the importance of open-ended, significant, challenging, and interesting enquiry

Figure 1. Stages of the SOLE approach (StartSOLE, 2016)
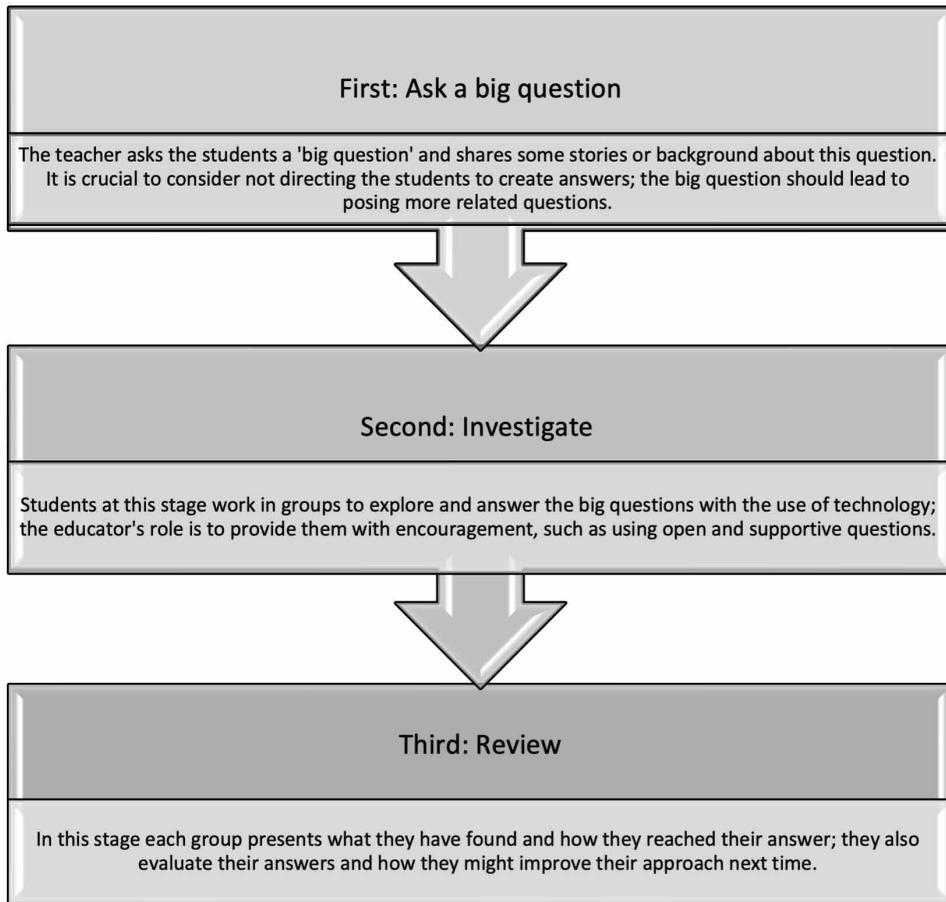
questions, as these questions should encourage students to think critically and propose theories rather than providing shallow responses (StartSOLE, 2016).

Studies Related to SOLE

Multiple studies have explored SOLE's effectiveness, particularly in school settings (Weisblat et al., 2019; Dangwal, 2018; Akram & Ghani, 2019). Weisblat et al. (2019) conducted a two-year study in the US involving more than 500 SOLE groups across 100 classrooms. The findings were encouraging, as students exhibited increased control over their learning and developed various skills, including leadership, communication, research, teamwork, and technological skills, when tackling the main set of questions. Initially, students tended to seek immediate answers, but they gradually learned to break down questions, communicate, evaluate resources, and sift through multiple potential answers to gain a deeper understanding of the subject. In India, Dangwal (2018) conducted a study comparing English reading comprehension among primary-school students in an experimental group exposed to SOLE, which was itself in a dedicated lab with a control group. The results indicated that the students in the experimental group showed improvement in English comprehension compared to the control group. Similarly, Akram and Ghani (2019) conducted an experimental study in Pakistan to assess the effectiveness of the SOLE approach in enhancing English reading comprehension in a primary school using a pre- and post-test protocol. The test results for the two groups of participants revealed

that the impact of SOLE on the reading comprehension of ESL students was apparently greater in the experimental group in comparison to the traditional-learning group.

Limited research has been conducted on the impact of the SOLE pedagogy in higher education, despite numerous studies in primary schools (Al Zakwani, 2020; Amit, 2020). The study by Amit (2020) explores the effects of SOLE on student motivation and learning engagement in a physiotherapy course. The findings indicate student satisfaction, good scores in internal examinations, and improved retention of knowledge through group discussions.

Clark (2016) conducted a study in the UK to investigate the impact of SOLE on student engagement in higher education by comparing the students' learning engagement within two approaches (SOLE and a traditional seminar). The study finds no significant difference in learners' engagement within a SOLE class compared to that in a traditional seminar that the same students had previously attended. The researcher mentioned that, within the traditional seminars, the students must do some reading before the class and answer the lecturer's questions during the class after gathering themselves into groups. This means that the students within the two approaches played an active role during their classes. Thus, it appears that research results in the field vary depending on the traditional approach used in a higher education setting in developed and developing countries.

Indeed, a similar result was found by Tsai et al. (2020) when they conducted experimental research. Two innovative methods called ubiquitous learners as designers (LaD) and ubiquitous self-organized learning (SOL) groups were implemented. The study involved first-year university students enrolled in a course titled "Applied Information Technology: Data Processing." The findings of the research revealed that the LaD method had a positive effect on improving students' computing skills. However, the ubiquitous SOL method did not demonstrate any significant impact on students' computing skills, engagement, or academic motivation (Tsai et al., 2020). This could be because the SOLE approach cannot be effective when implemented with scientific courses and would be better with literary and social courses. Ma (2018) supported that when he found that the effectiveness of the SOLE approach differed between history and mathematics classes, as his study indicates that students had a positive experience and showed improvement in their history scores through SOLEs. However, no significant improvement was observed in the students' mathematics scores compared to non-SOLE classes during the exams (Ma, 2018).

Indeed, one of the main challenges of the self-organized learning environment approach is the complexity of identifying individual learning processes within a group setting. Therefore, observing student interactions and their responses to activities is essential. In this context, Preston et al. (2018) proposed a framework that utilizes embedded sensing to collect data and analyze learning, explicitly aiming to identify individual learning processes within a group. This approach is beneficial for educators in gaining a comprehensive understanding of how to address issues related to the complexity of the "what and how" of evaluation and assessment in unstructured and multi-device learning environments.

Studies also suggest that modifying and improving the SOLE approach is required. In this regard, Al Zakwani (2020) conducted participatory action research at an Omani university, using SOLE to enhance the learning experience of English as a foreign language (EFL) college students. The study utilizes desk-based computers with internet access to search for answers to SOLE big questions. The results reveal increased student autonomy and motivation in the English classes. The study highlights the effectiveness of using the internet as a learning tool when implementing the SOLE approach, with potential benefits for learning outcomes and personal development (Al Zakwani, 2020). Meanwhile, Al Zakwani, in the same study, emphasizes the need to modify the SOLE pedagogy, including adjusting the teacher's role and incorporating additional context-based questions alongside the main questions. The suggestions include assuming roles such as supervisors and monitors and making decisions such as regrouping students when necessary.

Most of the relevant research has used computers with internet access to search for answers to SOLE big questions (Al Zakwani, 2020; Du, 2020; Dangwal, 2018). Indeed, Du (2020) mentioned that,

within the SOLE approach, the technology tools that have been used are internet-enabled electronic devices such as laptops or tablets; these devices are used mainly to access the internet to help the students reach different resources to search for answers. This was through the physical classroom, as the students worked collaboratively in groups to complete SOLE stages via one technology device for each group.

Meanwhile, a few studies have used smartphones as a technology tool within the SOLE approach (Tsai et al., 2020; Tsamago & Bayaga, 2023). For example, Tsamago and Bayaga (2023) conducted a study in South Africa to examine the impact of the SOLE pedagogy on students' metacognitive skills via their smartphones. The use of smartphones instead of computers was because of the lack of technology infrastructure within South African schools. The study found the SOLE pedagogy improved the students' different metacognitive skills. However, once again, these smartphones were limited to searching for information from internet sources.

This study, however, stands out as the first study that integrates mobile apps through the three stages of the SOLE pedagogy to enhance students' learning and engagement. In this study and while conducting the SOLE pedagogy, the students utilized mobile access to apps such as Padlet, Xmind, and the Google search engine for searching, discussing, visualizing, and sharing information in the classroom. Therefore, the researcher considers incorporating these mobile apps within the SOLE pedagogy stages unique and distinct from previous studies.

Mobile Learning

Technological advances impact formal and continuing education (Vishwakarma, 2015). Mobile learning is a part of the new learning landscape, enabling spontaneous, personal, informal, and situated learning (Vishwakarma, 2015). Mobile devices foster motivation, ownership, control, and communication with peers anytime, anywhere (Laurillard, 2007). According to Vishwakarma (2015), mobile technology creates an inclusive educational environment with online learning communities. It serves various purposes in learning, such as submitting homework, sharing ideas, and reflecting on immediate experiences (Sophonhiranrak, 2021).

Mobile learning is a type of e-learning that utilizes mobile devices for flexible and accessible learning experiences, catering to diverse learner needs and promoting enriched learning experiences (Moses, 2008). Vishwakarma (2015) suggests that mobile learning reduces formality by engaging reluctant students in the learning process.

Several research studies have utilized mobile devices to enhance active learning (Cabrera-Solano et al., 2020; Cheong et al., 2012; Laurillard, 2007; Gallegos et al., 2019). Mobile learning facilitates collaborative learning (Laurillard, 2007), improving students' collaborative experiences with their teachers and peers (Gallegos et al., 2019). Indeed, in their research, Cheong et al. (2012) designed a framework to enhance higher-order thinking skills and collaboration in learners using the myVote app. Their study explains the usage of the myVote app within three scenarios at various levels of thinking, from low to high order.

Cabrera-Solano et al. (2020) found that motivation, engagement, participation, and reducing learner anxiety are crucial for active engagement in learning through the use of the Formative app on mobile devices. The app facilitates active learning, direct involvement in class activities, and knowledge demonstration (Cabrera-Solano et al., 2020). According to Gallegos et al. (2019), students report positive experiences when using mobile devices for learning. They benefit from intentional device use, increased engagement with course concepts, reduced distractions, and improved collaboration with peers and instructors.

When an approach such as a mobile pedagogy is implemented, several factors should be considered, including learners' and instructors' readiness, learning management, and supporting systems (Sophonhiranrak, 2021). According to Okai-Ugbaje et al. (2020), the success of a mobile pedagogy depends largely on instructors' positive attitudes.

Within the Saudi context, many studies have encouraged the implementation of mobile learning (M-learning) in higher education, such as Almaiah et al. (2022) and Alturki and Aldraiweesh (2022). Several factors should be considered when implementing the mobile approach, such as providing a high-specification information technology infrastructure, increasing student awareness of the approach, and the importance of university management support by providing all the necessary resources to ensure the development success of the mobile project (Almaiah et al., 2022). However, M-learning cannot be integrated effectively within an education system heavily based on the traditional approach (Albazie, 2018). Thus, there is a need to find a balance between the curriculum and the teaching practice of universities seeking to integrate M-learning (Alhajri, 2016).

METHODOLOGY

Research Design

Critical participatory action research (CPAR) was employed in this study as a disciplined way of making the change (Kemmis et al., 2014). CPAR "is a social process of collaborative learning for the sake of individual and collective self-formation, realized by groups of people who join together in changing the practices through which they interact in a shared social world" (Kemmis et al., 2014, p. 20).

Action research is considered an effective approach to implementing change and improvement (Gopang et al., 2015). Action research includes planning the change, acting and observing, and reflecting and replanning (Kemmis et al., 2014). However, these stages overlap, and the initial research plan can be modified in light of individuals' learning experiences (Koshy, 2005). Thus, adopting critical participatory action research does not necessarily entail following the steps faithfully; it is more about having participants who have an authentic sense of development and evaluation of their own practice (Kemmis et al., 2014).

The research addresses student-engagement issues caused by Covid-19 social-distancing measures and the inability to work in groups and share materials in the classroom (after universities reopened following the pandemic). This means that, with the proposed method, the students were able to work together using the mobile apps without the need to be physically close. The research adopts the SOLE approach in conjunction with mobile access to apps like Padlet, Xmind, and Google as research interventions in the university classroom; see Table 1 for details of how the SOLE pedagogy is implemented via the use of various mobile apps. The Padlet app and the Xmind app have different versions, namely, the web-based tool and the mobile version. The students were limited to using the mobile version. This is because no computers or portable devices are available in the university's classrooms. The university has computer laboratories, but their number is limited, and they are used as practical classrooms. Students used the Google search engine to search for resources that would help them to answer the big questions; Xmind and other mind-mapping apps to visualize the content; and Padlet to facilitate communication and answer-sharing within groups. The group responses were presented via a projector connected to a mobile device, enabling other groups to view and share their answers (see Fig. 2).

This research was implemented with undergraduate female students studying an Educational Technology course. During this research, the students were asked a series of big questions on a weekly basis. Each big question was related to the planned weekly lesson.

The research comprised two phases. During the initial phase, which lasted two weeks, participants received an explanation of the SOLE pedagogy and instructions on engaging with the approach using mobile apps. The students followed three stages: answering the big question, investigating, and reviewing. They were encouraged to break down the big question into subsidiary questions. For instance, one of the big questions asked (which was related to the lesson entitled "The Use of Technology to Build 21st Century Skills") was, "Can technology promote students' creativity and

Table 1. How the SOLE pedagogy is implemented via the use of various mobile apps

SOLE Stage	How SOLE Is Implemented	The Use of Mobile Technology
First (Ask a Big Question)	- At the beginning of each weekly lesson, the lecturer asks the big question after having some face-to-face discussion with students about the topic. For example, the background of the topic may be discussed, or the lecturer may elaborate on the big question in more detail. - The students should then think critically to post sub-questions that should lead to answering the big question. - The lecturer then discusses their sub-questions (via face-to-face discussion) to help them pose more critical questions that are consistent with the big question.	- At the beginning of each lecture, one of the students within each group creates a new Padlet wall and shares it with their group members and with the lecturer. - The students within each group post their sub-questions on their Padlet wall.
Second (Investigate)	- In this stage, the students should answer the sub-questions via their mobile devices. - Each student in the group answers one of the proposed sub-questions. - During the first phase of the study, the lecturer gives the students feedback about their answers to challenge them critically. - During the second phase of the study, the students start to evaluate one another's answers by engaging in online discussion	- All students within each group have to search for the sub-question answers using the Google search engine, discuss their idea using Padlet comments or WhatsApp, and create the answer using some other apps such as Xmind to visualize their answers. Finally, they post their answers on the Padlet wall.
Third (Review)	- Each group presents and discusses its work (answers) with the class via face-to-face communication. - At the end of the lecture and after all the groups have presented their work, the lecturer engages in discussion with the whole class to ensure that all the lesson's objectives were covered (during the second phase).	- The lecturer helps and encourages each group to share its work on the Padlet wall with the whole class via the wireless projector.

innovation?" This was further explored through subsidiary questions such as, "What technology tools foster student creativity?" and "How does virtual reality enhance interactive learning experiences and promote creativity?"

In the second phase, lasting eight weeks until the end of the semester, some improvements were made to the intervention. For example, the lecturer noticed that some of the students' posts were not accurate or they were not answering the questions critically; thus, the students received additional instructions on critically evaluating information and the importance of careful reading before posting on the Padlet app. Furthermore, from informal conversations with the participants, the lecturer noticed their concerns about their understanding of the subject knowledge, and thus dedicated time was allocated at the end of each lecture for comprehensive discussions to ensure complete coverage of the essential knowledge of each course lesson.

Convenience sampling of two classes was adopted in this study. Both classes were students enrolled in an Education Technology course. All students from these two classes were involved in this study, comprising 27 third-year undergraduate female students. The first class had 15 participants (four groups) while the second class had 12 participants (three groups). All the participants were taught by the same lecturer.

The participants were exclusively third-year female students from the Early Childhood Department in the School of Education at Imam Abdulrahman Bin Faisal University (IAU), in Saudi Arabia. All participants in this study were female, as the specialization selected is offered exclusively to female students in all Saudi universities. From the research interviews, it has been noted that all the participants who engaged in the study were between 20 and 22 years old, and they each had a smartphone and extensive experience using mobile apps.

Figure 2. Classroom illustration of the SOLE pedagogy via learners' mobile devices
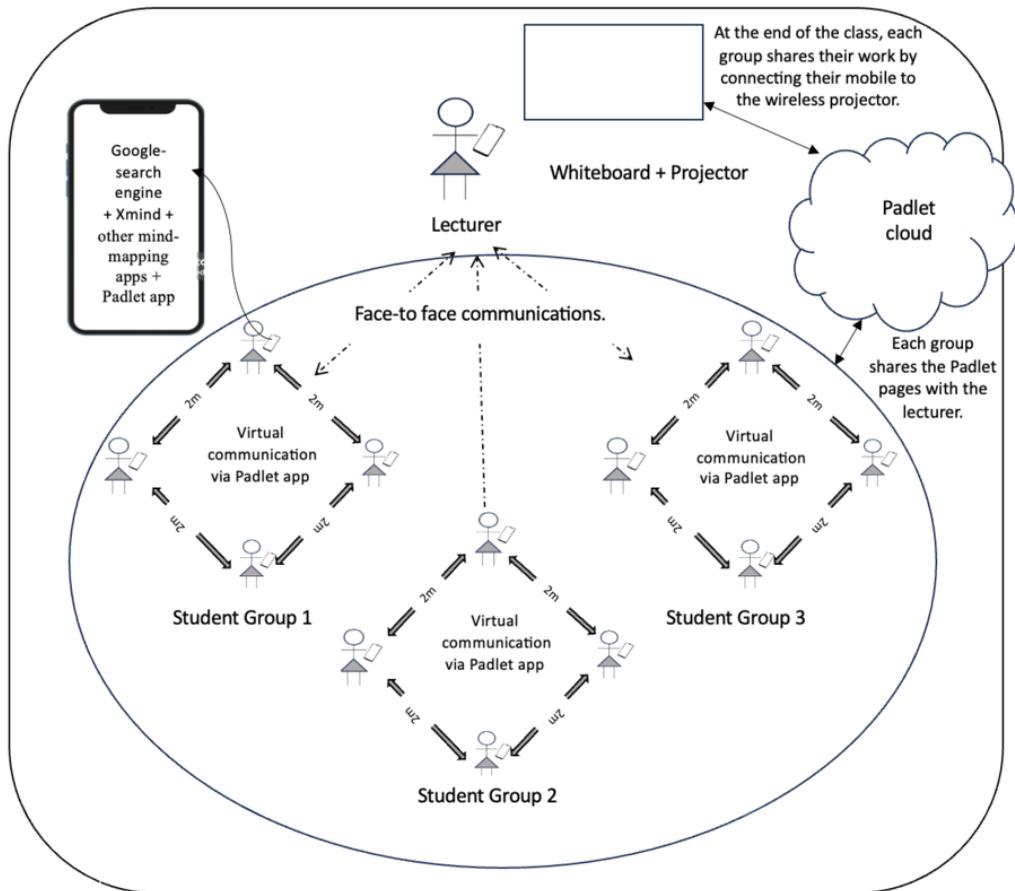
METHODS

Qualitative semi-structured interviews are regarded as a valuable tool for researchers to explore and investigate individual experiences in depth and detail (Cohen et al., 2011; Seidman, 2013; Denscombe, 2014). Within this research, 15 participants (seven from the first class and eight from the second) agreed to be interviewed at the end of the semester.

Informal conversations were conducted during this study to understand the students' experiences and to help improve the intervention in the second research phase. Informal conversation is considered to be a type of interview that can be implemented during action research (Kemmis et al., 2014). The conversations were reported within the researcher's diary.

Focus-group discussions consisted of two groups: the first had five students from the first class, and the other had six students from the second class. During the focus groups, the students discussed and shared their opinions on the study intervention and whether such a method was effective.

From the beginning of this study, the researcher kept a researcher's diary that consisted of all activities and decisions that she made, and it also contained the learners' online observations of how they answered the big questions and how they interacted with one another. Furthermore, the researcher's diary reported all the classroom observations of how the students engaged with this method. Additionally, the research diary contained reflections on some aspects of the research; for

example, the researcher was aware that her dual role could impact the research findings, and so, to address this issue, she wrote a reflective journal entry after each lecture to describe and reflect on aspects of this study to separate her beliefs and thoughts as a researcher from those as a lecturer on the course. Table 2 highlights the data-collection methods used during the two phases of the critical participatory action research.

The use of all of these methods helped the researcher to understand the participants' experiences when engaging with the SOLE pedagogy via their mobile devices and therefore helped to answer the research questions.

Participants were assured that their involvement would have no consequences, and their decision not to participate would not negatively affect them. Ethical approval was obtained for this study from IAU, where the study took place. The specific aim and purpose of the research was explained to the students at the beginning of the semester. They were also provided with an information sheet about the study, and the researcher discussed her participation with them before asking for their written consent. All the participants' data were kept confidential through the use of pseudonyms to maintain anonymity. The responses were used solely for the academic purpose of fulfilling the research aims.

A thematic analysis framework proposed by Braun and Clarke (2012) was adopted. The thematic analysis consisted of six steps: familiarizing oneself with the data, generating codes, writing the themes, reviewing the themes, defining the themes, and writing the relevant reports. Table 3 shows the coding tables of the study findings.

Finally, member checking was adopted in this research to increase the validity of this qualitative research (Birt et al., 2016; Creswell & Poth, 2017). The participants were sent a summary of the final report via email. Afterwards, the researcher met with them to discuss the meaning of the emerged themes, and they agreed on the meanings extracted from the conversations in the course of the research.

RESULTS AND DISCUSSION

The results of the current study were reached by collecting data from all research methods used, as combining data resources helped in understanding the undergraduate female students' perspectives on the applied approach. The results of this research fell into two main themes to answer the two sub-questions. Within each main theme, the sub-themes emerged inductively, as detailed below.

Positive Aspects of the Implementation of SOLE via Usage of Mobile Apps

Five sub-themes emerged to answer the first SQs, as set out below. All of these sub-themes resulted from the combination of implementing SOLE and the use of mobile apps; indeed, with the use of mobile apps, implementing the SOLE pedagogy is possible within the unusual circumstances of having to maintain physical distance during the Covid-19 pandemic restrictions.

Engagement Opportunities

It was found that implementing SOLE via mobile apps allowed opportunities for student participation and enhanced integration in the educational process.

Eight participants confirmed that the SOLE approach provided them with an opportunity to participate effectively. Indeed, this approach was considered to be supportive of students' positive

Table 2. Data-Collection methods used during the two phases of the critical participatory action research

Week No.	1	2	3	4	5	6	7	8	9	10	11	12
Research Phase	First Phase		Second Phase									
Data-Collection Method	Researcher's diary Informal conversations										Focus group	Interviews

Table 3. Highlights of the coding tables of the study findings

Theme	Sub-theme	Codes
Positive Aspects of SOLE	Engagement opportunities	Participate effectively
		Active role of students
		Discussing answers
		Overcome shyness
	Enhancing a spirit of cooperation	Cooperating with each other
		Performing cooperative tasks
		Communication and accomplishments
	Classes became more enjoyable	Enjoyed the method
		Reduced boredom
		Filled with harmony
		Lecture was interactive
	Opportunity to evaluate ideas	Evaluate ideas
		Exchange different information
	Understanding and recall of information	Information became memorizable
		Increases the effectiveness of learning
Negative Aspects of SOLE	Misleading information	Not evaluating information
		Subject is tricky
		Inaccurate information
	SOLE alone is not sufficient	Not covering all course subjects
		Insufficient on its own
		Implementation of SOLE with other methods
	Technical issues	Slow internet speed
		Mobile distractions
		Padlet app is limited
		Padlet app is expensive

and active roles, as affirmed by participants Noura, Mariem, and Khulud. Mariem mentioned that her involvement had become more active, as it allowed her "to search independently for information instead of receiving it." Noura expressed that the SOLE approach granted her the chance to participate, adding, "There is a chance for each of the students to participate" (see Table 1).

The time dedicated to sharing information during the third step of the SOLE approach, namely the review stage, was found to be beneficial for the students. According to Salwa, "The lecturer provides an opportunity for sharing and discussing answers, allowing us space for expression." This approach also helped students overcome shyness when participating in social activities. Salwa commented, "This methodology was beneficial for girls who were socially shy." Noura added, "Using this method helps us communicate and talk with each other after returning from online education."

Salwa mentioned that communication and interaction were initially challenging for them at the beginning of the semester due to the Covid-19 pandemic restrictions and the prolonged period of isolation, which lasted for about 18 months. This situation affected their ability to initiate interactions or even have conversations with each other. However, according to many participants, this new method

encouraged students to collaborate and actively participate in class within both virtual and face-to-face communication (see Fig. 2).

From the above results, it can be emphasized that the students had more opportunities to engage and communicate effectively with each other as a result of implementing the SOLE approach via mobile apps in their classrooms. This finding aligns with the conclusions of Weisblat et al. (2019), who observed 500 SOLE groups in 100 classrooms over two years. They found that communication occurred much more between students than between the teacher and the students, as in traditional education. During their observations, they noticed an increase in student participation, with 90% engaging in conversations with others at least once every five minutes (Weisblat et al., 2019).

Enhancing a Spirit of Cooperation

Many of the students confirmed that the SOLE method supports a spirit of cooperation. Monira agreed: "This method (implementing SOLE via mobile apps) gives us more chance to cooperate with each other." Salwa added, "It helps us to perform cooperative tasks." Furthermore, this method (implementing SOLE via mobile apps) helped the students in terms of their communication and accomplishments, even while they were still adhering to Covid-19 precautions. Zuhor said, "Using this mobile technology was good for completing tasks requiring cooperation, especially with the imposed physical distancing." (See Fig. 2.)

In short, it is found that the implementation of the SOLE approach using mobile apps enhanced cooperation among learners in investigating the SOLE big question. This finding corresponds with Al Zakwani's (2020) study when using SOLE to enhance his EFL students' learning experiences. His research reported that "SOLEs boost cooperation" (p. 191). He further explained that cooperation helped learners achieve their learning goals by clarifying ambiguity through correcting one another and sharing information, which is vital in learning English (Al Zakwani, 2020). In this research, cooperation was facilitated by students' engagement in critical online discussions, which resulted in thoughtful posting on the Padlet wall after evaluating their ideas.

Classes Became More Enjoyable

Initially, the purpose of the SOLE via the mobile apps was not clear to the students. However, as the approach was reiterated and support was provided to help them grasp the concept, they began to appreciate this new learning method. Heaton expressed, "At first, the method was unfamiliar, and I wasn't convinced by it. However, I liked it later, especially the active atmosphere when we explored information independently." Mariem added, "We enjoyed the method, as it allowed us to connect with new students after the lockdown."

Salwa affirmed, "It became more enjoyable as we worked together in groups and searched for information." Munira shared, "Without using this method, I found lectures boring and excessively long. However, using this method reduced my boredom." Salwa mentioned that the "group was pleasant, enjoyable, and harmonious. Other lectures were repetitive, whereas yours [referring to the researcher's lecture] was interactive."

Enjoying the implementation of SOLE using mobile apps during the lectures was likely because the use of the SOLE approach transformed the traditional teacher-centered classroom into a more active and enjoyable student-centered environment (Weisblat et al., 2019). Al Zakwani (2020) also concluded that SOLE motivates students to learn, and Amit (2020) found that university students were satisfied with the implementation of SOLE in their classrooms.

Opportunity to Evaluate Ideas Before Posting

Initially, the participants in this critical participatory action research tended to provide superficial answers to the main or big questions. However, over time, they developed the ability to evaluate information before posting. Engaging with SOLE stages via the shared Padlet wall and receiving feedback from the lecturer about the students' online posts helped the students consider and assess

ideas via online discussion before sharing them. For example, the lecturer may ask whether the content is reliable. Does it have references or not? Moreover, is their answer supported by relevant evidence or related theories? This enables students, especially during the second phase of this research, to progress from merely posting superficial ideas to evaluating information before sharing it. Munira stated, "Initially, we would share any idea, but later we began evaluating them all individually and collaboratively." Mariem added, "We also learned to generate sub-questions based on the main questions. This facilitated the exchange of diverse information from various perspectives. We shared information, selected the best, and post[ed] it."

This aligns with the conclusions of Weisblat et al. (2019), who observed that, during the initial implementation of SOLE, participants simply copied information from the first source they consulted. However, with time, they learned to break down the questions, evaluate sources, and sift through different, and sometimes conflicting, information from multiple sources (Weisblat et al., 2019).

Understanding and Recalling Information

The SOLE approach facilitated information retention among students because they were actively involved in searching for it. Hana expressed, "Researching information makes it more memorable. I can now easily recall lesson titles and relevant information." Haifa commented, "SOLE is an effective method for learners, as it enhances understanding and information recall. It increases learners' effectiveness as they investigate the question and share information." According to Noura, "It is a valuable and practical method, as it allows me to search for information independently. It is engaging for me to search for information, verify it from credible sources, and refer to available references when selecting the appropriate answer."

The process of analyzing questions, searching for information, and collaboratively discussing ideas in groups helped the learners in this study to recall and understand the subjects covered. According to social constructivist theory, knowledge construction occurs when learners interact collaboratively with one another. Amit's (2020) study supports this, indicating that academic scores in the SOLE group were generally higher compared to groups using traditional methods. Furthermore, "The retention power of the topic is also increased when they work in a group and discuss the problem, as it becomes an event rather than a session or class full of lectures" (Amit, 2020, p. 28).

Negative Aspects of the Implementation of SOLE via Mobile Apps

Three sub-themes emerged to answer the second sub-question, the first two related to the implementation of SOLE via mobile apps and the third sub-theme concerning the negative aspects related to the technology used.

Misleading Information

Some students mentioned that investigating some complicated topics (within the second stage of the SOLE pedagogy via the students' mobile apps), particularly when the students do not have sufficient background about the raised topic, could result in inaccurate or misleading information. Hana expressed concern, stating, "We understand that information can be inaccurate." Munira added, "Sometimes, if the subject is tricky and we do not know about it, students may post inaccurate information." This was evident during the initial phase of the study, as observed by the researcher in her reflective journal, when students recorded information without reviewing or evaluating it, leading to inaccuracies. However, this challenge was addressed as the students recognized the importance of critically evaluating information before posting it. This was also found within the Weisblat et al. (2019) study, when they noticed that the students simply copied the information from the first resource they found during the initial phase of implementing the SOLE approach; however, they gradually learned how to engage critically with their answers by evaluating them carefully.

SOLE Alone is Not Sufficient

Some students expressed that the SOLE approach via the mobile apps alone may be insufficient to cover all course subjects comprehensively. Noura pointed out the need for more detailed information, stating, "We require additional details, as some of the information is new to us and we struggle to grasp all the points." Nada added, "There might be a lack of understanding for certain topics, so it was better when the lecturer provided comments on students' answers and incorporated this method alongside SOLE."

Indeed, when the participants were asked about their opinions on implementing SOLE via mobile apps alone without having to engage in a discussion about the lesson topics and objectives at the end of the lecture, several students, including Haifa, Nada, Rana, and Noura, were particularly concerned about effectively covering the entire curriculum to answer exam questions accurately, as exams account for 60% of their grades. Haifa expressed her concern, saying, "When using SOLE alone, we might not be able to address and comprehend all the curriculum subjects, which can pose difficulties in our studying and examinations."

In light of this, Nada supported the idea of combining the implementation of SOLE with other methods, as was applied during the second phase, where SOLE was accompanied by in-depth discussions and final revisions at the end of each lecture. This ensured comprehensive coverage of all curriculum components, which would be challenging when relying only on the SOLE approach.

Therefore, this research argues that implementing only the SOLE approach via the mobile apps is insufficient within the current Saudi education system, which relies heavily on formal examinations (Al Alhareth & Al Dighrir, 2014). Therefore, it is crucial to combine SOLE with other approaches in the Saudi context to cover the entire course syllabus and assess students' academic progress fairly, following a well-designed evaluation plan.

Additionally, there is a significant need for education faculties in Saudi universities to consider and develop a more flexible undergraduate curriculum that does not rely primarily on the examination system to evaluate students' learning outcomes. Indeed, the relevant literature argues that there have been vigorous efforts to develop teacher-education programs, usually accomplished by specialized committees in education faculties. These efforts have resulted in considerable progress in providing more-valuable practicum experiences within many Saudi universities (OECD, 2020). However, upon review of the teacher-education curricula, it is evident that there is a significant reliance on written exams to assess student knowledge. For example, at IAU, written exams account for 60% of the total grade assessment in most courses offered in teacher-education programs. This heavy reliance on written exams in assessment impacts the integration of the instructional strategies that support student-centered learning, since faculty members are likely to focus more on the quantity of information that needs to be covered to help students perform well on their exams. All of this may lead to neglecting the other significant soft skills and competency-based learning that should be targeted within teacher-education programs.

In this regard, Arnove (2020) advocates for the significance of a shift in focus from the quantity of knowledge acquired to the quality of learning and how it is achieved. Furthermore, Zhao and Watterston (2021) report that, as education undergoes changes, students will increasingly adopt competency-based learning, which prioritizes the development of unique skills and abilities. Therefore, implementing innovative teaching methods that incorporate the use of technology with the aim of enhancing and developing soft skills and critical thinking will be crucial for future generations of Saudis. This is supported by Saudi Vision 2030 when it emphasizes the significance of developing learners' lifelong skills to help them fulfill future labor market needs (Saudi Vision 2030, 2023).

Technical Issues

In this research, technical issues were encountered when using mobile apps such as Padlet, Xmind, and the Google search engine to answer the big questions in the SOLE approach. Some students encountered issues with slow internet speed, which affected their ability to access and receive timely

information. Hana mentioned, "The slow internet problem sometimes hinders us from seeing the new posts from others, or sometimes the same content may be repeated due to delayed delivery." Khulud experienced difficulties with Padlet, stating, "Padlet is not smooth. I sometimes get signed out, leading to information loss, possibly due to the slow internet connection."

The university's free internet service was unreliable and slow, prompting some students to rely on their own internet providers. However, even with their personal services, some students still faced slow internet speeds.

Slow internet speed on mobile devices was one of the main problems causing inconvenience for students who could not access updated content on the Padlet app, where they had to sign in repeatedly. Similar issues have been found in other studies where technology was used to enhance learning, presenting serious challenges. For instance, Coman et al. (2020) discovered that technical issues were prevalent and posed difficult problems that Romanian universities had to address during the Covid-19 crisis. These issues were mainly caused by the hosting services provided by the universities. Similarly, infrastructure and technology problems have been identified as common obstacles affecting the successful implementation of e-learning in Saudi Arabia (Quadri et al., 2017).

Students also found the use of the mobile device distracting, particularly when receiving personal messages from other mobile apps. Rana expressed, "Using the mobile sometimes distracts me, as I receive messages from other apps that require my attention." This result aligns with those of other studies, such as a study conducted by Kay et al. (2017), which found that, when students use their mobile devices in the classroom to enhance their learning, they engage in some distracting behaviors, such as using social media and instant messages.

Furthermore, participants highlighted a number of limitations with using the Padlet app. Zuhor remarked, "The Padlet app has restrictions; it allows a maximum of only four walls, and the subscription cost is high." In the free trial version of Padlet, students took turns creating and sharing walls to make the most of the available capacity.

Limitations

This study has several limitations that need to be acknowledged. First, the author's dual roles as a teacher and a researcher may have influenced the research findings and student participation. This issue was mitigated by the researcher maintaining a weekly reflective journal, as explained within the Methodology section. Second, the generalizability of this research is limited. However, as highlighted by Creswell (2014) and Creswell and Poth (2017), qualitative research aims to comprehend the specific context in which the results were generated rather than generalizing them.

CONCLUSION AND RECOMMENDATIONS

In the post-Covid-19 era, there is a need to reconsider education in light of emerging challenges and opportunities (Cahapay, 2020; Tesar, 2020). Educators must address these challenges carefully and critically to enhance learning environments.

Many participants faced difficulties engaging in face-to-face classes and collaborative group work due to the Covid-19 restrictions. To address this issue, a SOLE pedagogy using mobile apps was implemented. This study aimed to explore third-year undergraduate female students' perspectives on implementing the SOLE pedagogy. The research found that SOLE provided engagement opportunities that improved cooperative learning and group effectiveness, making lectures more enjoyable. SOLE also encouraged students to evaluate their ideas before sharing them, facilitating understanding and recalling information.

The critical participatory action research identified challenges, including technical issues and misleading information, associated with the proposed approach. Moreover, participants emphasized that implementing SOLE alone is insufficient within the current education system. Combining it with other approaches, such as in-depth discussions, could ensure comprehensive coverage of the

course syllabus. Education faculties should also develop undergraduate curricula and course plans that prioritize the improvement of soft skills and competency-based learning (Snell, 2014).

This research proposed a combination approach of implementing SOLE via mobile apps to overcome the difficulties due to the unusual circumstances of Covid-19 restrictions. This could enlighten the local and international practical teaching approach when facing similar situations. The research could inspire educators working within a similar education system (which relies heavily on formal examinations) to implement innovative approaches that support student-centered learning. Finally, more research is needed on innovative teaching approaches that could be combined with mobile apps to develop learners' lifelong skills within the Saudi context.

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