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Enhancing Math Pass Rates with Simple Tools Like WhatsApp: A Literature Review

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Abstract:

This study explores the innovative use of WhatsApp as an educational tool within the Open Distance e-Learning (ODeL) environment at the University of South Africa (UNISA), specifically targeting the Mathematics module MAE103L. Addressing the challenges posed by remote learning, this research evaluates how WhatsApp, a widely accessible and user-friendly mobile messaging app, can significantly improve student engagement and academic outcomes. Through a literature review and qualitative analysis, the study draws upon Social Learning Theory to demonstrate how observational learning, modeling, imitation, reinforcement, and motivation facilitated by WhatsApp can enhance learning dynamics. This study focuses on the period from 2019 to 2021, during which WhatsApp was leveraged to

manage large student groups, distribute educational resources, and foster a collaborative learning atmosphere. Findings indicate that the implementation of WhatsApp contributed to a notable increase in pass rates from an initial 30% to 94% by mid-2021. The study underscores the potential of mobile technology to transform educational practices, particularly in resource-constrained settings, while also highlighting the challenges related to the digital divide and data privacy. Recommendations for maximizing the educational benefits of WhatsApp include structured activities and guidelines for managing group interactions to maintain focus on educational objectives. This research contributes to the broader discourse on integrating mobile technologies in education, providing empirical evidence of the benefits and limitations of such tools in enhancing student performance.

Enhancing Math Pass Rates with Simple Tools Like WhatsApp: A Literature Review

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Introduction

The rapid advancement of digital technology has significantly transformed educational methodologies, offering new avenues for enhancing student engagement and academic performance. Among these technological innovations, mobile messaging applications like WhatsApp have emerged as effective tools in facilitating communication and collaborative learning. This study explores the use of WhatsApp as an educational tool to improve pass rates in the module Measurement in Intermediate and Senior Phase

Mathematics (MAE103L) at the University of South Africa (UNISA). Given the unique challenges faced by students in Open Distance e-Learning (ODeL) environments, leveraging WhatsApp's widespread accessibility and familiarity presents a promising solution to enhance learning outcomes.

Research indicates that mobile learning applications, particularly WhatsApp, can significantly enhance student engagement and academic performance. For instance, Alqahtani and Rajab (2022) found that WhatsApp groups facilitated improved understanding and retention of mathematical concepts among high school students in Saudi Arabia. Similarly, Nkambule (2023) and Gawade et al. (2023) highlighted that students who received supplementary educational materials via WhatsApp performed better in assessments compared to those relying solely on classroom instruction. These findings suggest that WhatsApp can be an effective tool for overcoming the limitations of traditional online learning platforms, particularly in ODeL settings.

Background

Despite the flexibility and accessibility offered by ODeL institutions like UNISA, many students struggle with self-directed learning, particularly in complex subjects such as mathematics. According to Armes-Thomas et al. (2022), the isolation often experienced in distance education can negatively impact student motivation and performance. This is exacerbated by the limited engagement on traditional online platforms, as noted by Abiltarova et al. (2022), who found that the lack of interactive and immediate communication tools in ODeL can lead to lower student participation and higher dropout rates. Specifically, the pass rate for the module MAE103L was alarmingly low, at around 30% when I first adopted it. The need to find more effective ways to engage students and improve their understanding of mathematical concepts is critical to enhancing their academic performance and overall educational experience.

UNISA enrolls a diverse student population from various backgrounds, many of whom face significant challenges, including limited access to resources and reliable internet connectivity. In South Africa, rural areas often suffer from poor network coverage, making it difficult for students to participate actively in online learning activities (Afolabi & Ajani, 2023). Additionally, many UNISA students are employed full-time, which further complicates their ability to engage with the university's learning platforms during conventional hours. Traditional methods of communication and instruction, such as the myUnisa discussion forums, have proven insufficient in addressing these challenges (Brown & Czerniewicz, 2010). The introduction of WhatsApp groups provided a more accessible and engaging platform for students to interact, seek help, and collaborate on academic tasks, thereby fostering a more inclusive and supportive learning environment.

While the benefits of digital tools in education are well-documented, there is limited research specifically focusing on the use of WhatsApp in ODeL settings to improve academic performance in mathematics. Most existing studies have explored the general use of mobile learning applications or the impact of WhatsApp on social sciences and language learning. This study aims to fill this gap by providing empirical evidence on how WhatsApp can be used to enhance student engagement and pass rates in a mathematics module within an ODeL institution.

Literature Review

The integration of WhatsApp in educational settings, particularly in Open Distance e-Learning (ODeL) environments like the University of South Africa (UNISA), has shown promising potential in enhancing student engagement, learning outcomes, and academic performance in mathematics. This comprehensive literature review assesses the effectiveness of WhatsApp as a

tool for improving pass rates in mathematics courses, focusing on studies that explore various dimensions of its educational impact.

Enhanced Learning Outcomes and Student Motivation

Research consistently highlights that WhatsApp can significantly improve learning outcomes and boost student motivation. For instance, Alqahtani and Rajab (2022) reported that in Saudi Arabian high schools, the use of WhatsApp for supporting mathematics learning markedly improved students' understanding and retention of mathematical concepts. Similarly, Nkambule (2023) and Gawade et al. (2023) noted that students who received supplementary materials via WhatsApp outperformed those who relied solely on traditional classroom instruction. This platform's interactive capabilities allow students to discuss and solve mathematical problems collaboratively, boosting their proficiency and engagement.

Increased Student Engagement

Studies such as those by Lee, Chern, and Azmir (2023) in Malaysia have shown that WhatsApp enhances peer support and fosters academic discussions among university students, facilitating timely communication between students and instructors. Nyembe and Howard (2021) and Bustos-González and Castro-Salazar (2021) echoed these findings, highlighting WhatsApp's role in improving communication and collaboration, thereby deepening students' understanding of the material and enhancing academic performance.

Support for Collaborative Learning

WhatsApp supports collaborative learning by enabling dynamic interactions among students and between students and teachers outside traditional classroom settings. Nkambule (2023) and Gawade et al. (2023) highlighted that although the platform could improve learning outcomes, challenges such as managing large message volumes and maintaining student focus needed

addressing. Despite these issues, WhatsApp's features, including group chats and multimedia sharing, enable active participation and instant feedback, fostering a community feeling among learners and enhancing their collaborative skills.

Distribution of Educational Resources

The utility of WhatsApp as an effective platform for distributing educational materials is well-documented. Law et al. (2020) and Dobbins and Denton (2017) stressed that the ability to access and review materials such as lecture notes, videos, and quizzes anytime significantly aids in reinforcing learning and retaining concepts, which is crucial in complex subjects like mathematics.

Challenges and Considerations

Despite its advantages, the use of WhatsApp in educational settings presents challenges, including the digital divide, data privacy concerns, and the need for structured teacher training. Issues such as managing large volumes of messages and minimizing distractions through clear guidelines and structured usage must be addressed to maximize the platform’s educational benefits, as noted by Jain (2019). This approach reduces cognitive distractions for the recipient and allows the sender to anticipate when a response might be expected, without causing excessive interruptions for the recipient.

Despite the extensive documentation of digital tools' benefits in education, there is a conspicuous gap in research specifically focusing on the use of WhatsApp in ODeL settings to improve academic performance in mathematics. Most existing studies have concentrated on the general use of mobile learning applications or the impact of WhatsApp on social sciences and language learning. This review identifies a critical need for empirical research that provides focused insights on how WhatsApp can be strategically used to

enhance student engagement and pass rates in mathematics modules within ODeL institutions like UNISA.

Theoretical Framework: Social Learning Theory

To effectively apply Social Learning Theory (SLT) as the theoretical framework for a study on the use of WhatsApp to enhance math pass rates in an Open Distance e-Learning (ODeL) environment like UNISA, it's essential to connect key components of the theory to the specific educational practices and outcomes observed with WhatsApp usage. This framework, developed by Albert Bandura, offers a comprehensive approach to understanding learning in social contexts through observation, imitation, modeling, reinforcement, and motivation.

Key Components of Social Learning Theory

Observational Learning:

Observational learning is a core principle where students learn by observing the behaviors of others. Within the WhatsApp groups, students can observe how their peers approach and solve mathematical problems. Bandura (1977) emphasizes that seeing successful problem-solving strategies in action can improve learners' ability to replicate those strategies themselves.

Imitation:

Imitation is another critical aspect of SLT, where students replicate behaviors observed in others. In a WhatsApp setting, this could involve students adopting solution strategies that peers have shared in the group, which they found to be effective. Schunk (2012) suggests that imitation is more likely when the behaviors observed are seen as successful and are followed by positive outcomes.

Modelling:

Modeling involves more than just observation; it includes the replication of behaviors, attitudes, and emotional reactions of others. Instructors or more knowledgeable peers can act as models within WhatsApp, demonstrating not just academic content but also effective communication and problem-solving skills. Bandura (1986) notes that models are particularly influential when learners perceive them as similar to themselves or as successful.

Reinforcement:

Reinforcement in SLT can be direct or vicarious, and it significantly influences the likelihood of a behavior being adopted. On WhatsApp, reinforcement might come through positive feedback from peers or instructors, such as praise or recognition for solving a problem correctly. According to Bandura (1997), this type of reinforcement not only encourages the individual learner but also sets a precedent for other students in the group.

5. Motivation:

Motivation, driven by expectations of rewards, is a crucial element of SLT. WhatsApp can enhance motivation by providing a platform for immediate and interactive engagement with peers and teachers, making learning more dynamic and less isolating. Ryan and Deci (2000) articulate that intrinsic motivation flourishes in environments that are socially interactive and supportive.

Application to the Study

Observational Learning and Modeling: Investigating how students observe and replicate behaviors within WhatsApp groups and the impact of these behaviors on learning outcomes.

Imitation and Reinforcement: Analyzing which behaviors are imitated and how they are reinforced through interactions on WhatsApp.

Motivation: Examining how the use of WhatsApp influences students' motivation and engagement with the learning material.

Methodology

This study employs a qualitative case study design to investigate how WhatsApp can be used as an educational tool to enhance student engagement and learning outcomes in the MAE103L module at the University of South Africa (UNISA). It specifically examines the period between 2019 and 2021, focusing on students from diverse geographic and demographic backgrounds.

The main sources of data for this study include reflective narratives from the lecturer who oversaw the WhatsApp groups, archived messages and interactions within these groups, student performance statistics from this period, and some invitations received by the lecturer from individual colleges and at the university level to share these best practices. This multi-source approach enables a thorough analysis of both communication and learning dynamics within the groups.

The methodology is rooted in Social Learning Theory (SLT), which highlights the significance of learning via social interactions and observing peers and educators. The six themes emerged through a grounded analysis of the interactions and outcomes observed in the WhatsApp groups. These themes reflect the core principles of SLT and are supported by extensive literature, illustrating how WhatsApp can be effectively utilized in an educational setting. They include: Increase in Pass Rates; Enhanced Engagement and

Collaboration; Resource Distribution; Observational Learning and Modelling; Imitation and Reinforcement; Motivation; and Recognition and Broader Implications.

Ethical considerations are paramount, with the study adhering to guidelines that ensure the confidentiality and anonymity of the participants. This includes ethical clearance from UNISA's College of Education, which allows the lecturer to publish findings without revealing student identities or presenters' details where the programs are shared.

The study's methodology integrates theoretical grounding with empirical analysis to explore how digital communication tools like WhatsApp can effectively support learning in distance education settings. By analyzing the interactions within these groups through the lens of SLT, the study seeks to offer deeper insights into the potential of mobile technologies to enhance engagement and academic performance in an ODeL environment.

Findings

This study investigates the innovative application of WhatsApp as an instructional tool at an Open Distance e-Learning (ODeL) institution. Initiated by the encouragement of my teaching and learning manager, this exploration began with a seminar presentation titled “Using a Simple Tool Like WhatsApp and Other Methods of Teaching to Reduce Failure Rate—How Pass Rates Increased in Math Education” by Mbazima Ngoveni. This presentation was part of a series conducted at various educational levels within the college and university (see Figure 1).

Figure 1

Presentations made at one of the colleges (College of Accounting Sciences)

CAS WORKSHOP ON TEACHING METHODOLOGIES

09 MAY 2023

KGORONG FUNCTION HALL, MUCKLENEUK (MAIN CAMPUS)

PROGRAMME

08:30-09:00	Registration
09:00-09:10	Remarks on Effective Teaching and Cutting-edge methods *Dr Tshephe/Dr Nene : Programme Director*
09:15-09:45	Teaching Philosophies *Prof MD Magano*
09:50-10:30	Teaching Presence and TPACK *Dr P Makgato-Khunou*
10:30-10:45	**TEA/COFFEE BREAK**
10:50-11:15	Using Flipgrid/ Teams/ etc to record my lessons and how to upload onto myUnisa *M Pooe and Dr Sethusha*
11:15-11:45	PRACTICAL demonstration of engaging students using Constructivism - How my pass rates increased in CSET *Ngaka Mosia*
11:45-12:00	Questions
12H05-12H20	Using a simple Tool like WhatsApp and other methods of teaching to reduce failure rate-How pass rates increased in Maths education *Mbazima Ngoveni*

Background and Implementation

When I assumed coordination of the module "Measurement in Intermediate and Senior Phase Mathematics" (MAE103L) at the University of South Africa (UNISA) in 2019, I was confronted with the challenge of improving its historically low pass rate, which averaged around 30%. The advent of the COVID-19 pandemic in 2020 necessitated a transition to online examinations, further complicating the situation due to existing issues such as limited internet connectivity and inconsistent electricity supply among our diverse student body. This abrupt shift from venue-based exams to online formats significantly heightened student anxiety.

In response to these challenges, I turned to the WhatsApp platform, which proved to be an invaluable tool for communication and learning. I established multiple WhatsApp groups to effectively manage the large student body, enabling direct and real-time interactions. This approach not only facilitated immediate questions and answers but also greatly reduced dependence on

formal query systems (phone calls and e-mails), thereby making the learning process more accessible and responsive.

During the transition to online examinations, while many students were panicking, one student created a video explaining how to navigate the online examinations in Zulu, which was widely understood by most students. To ensure inclusivity, I coordinated a translation of this video into English with the help of a volunteer. Recognizing the value of this peer-led initiative, I disseminated the videos across multiple groups, where they were highly appreciated and effective in easing the transition.

Strategy Evolution and Management

Initially, in the second semester of 2019, I personally managed these groups, posting questions and handling responses during specific times as depicted in Figure 2. While this method initially boosted participation, it became unmanageable due to the large student body. Consequently, in 2020, I transitioned to a more feasible approach by designating student administrators to oversee the groups. This shift allowed me to concentrate on content creation and supervision. In this new setup, I established a central group with administrators who acted as intermediaries between me and the students. I shared activities with these administrators, who then relayed them to their respective teams. Students worked as a team in individual groups to solve problems, which not only facilitated knowledge sharing but also allowed students to post questions in the groups and be successfully assisted. Any unresolved issues within the groups were escalated to the central group, which consisted of administrators and myself. This change not only sustained high engagement levels but also encouraged students to play a more active role in their educational community.

Figure 2

WhatsApp Groups Activities, 2019

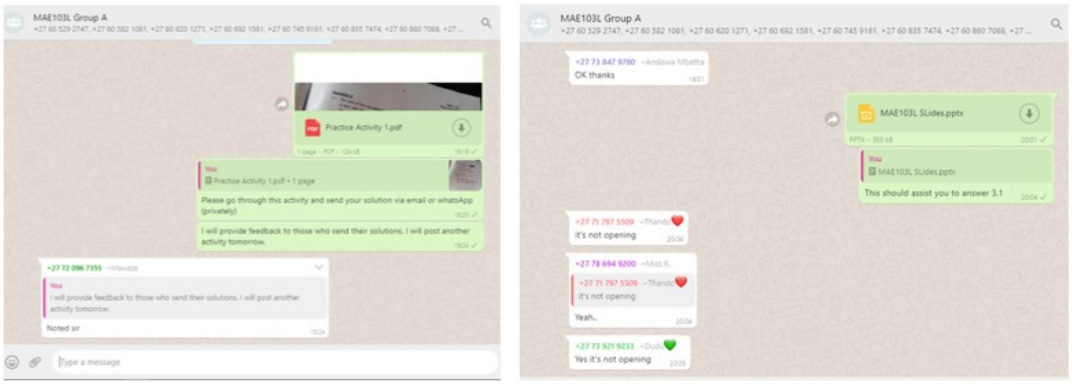
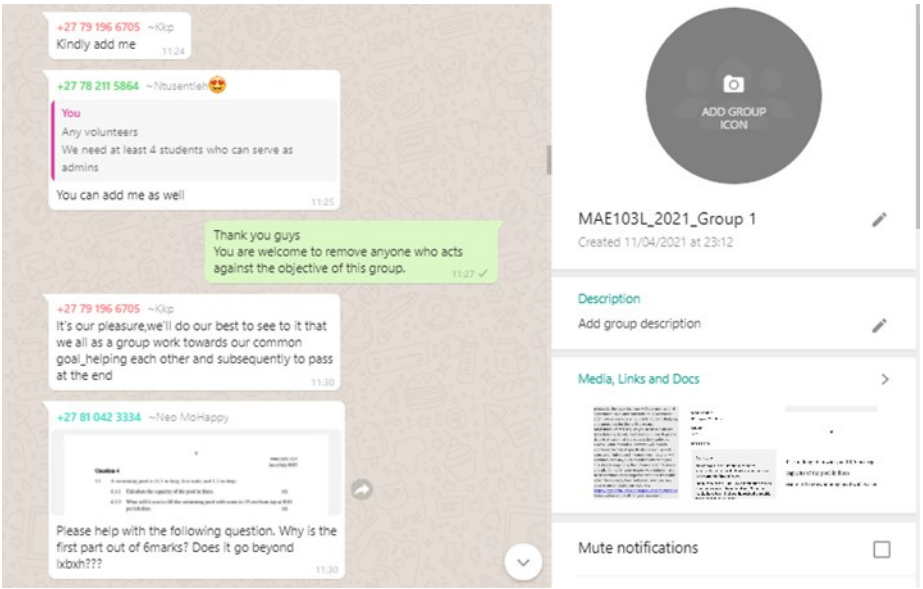


Figure 3

2021 WhatsApp Groups with Administrators



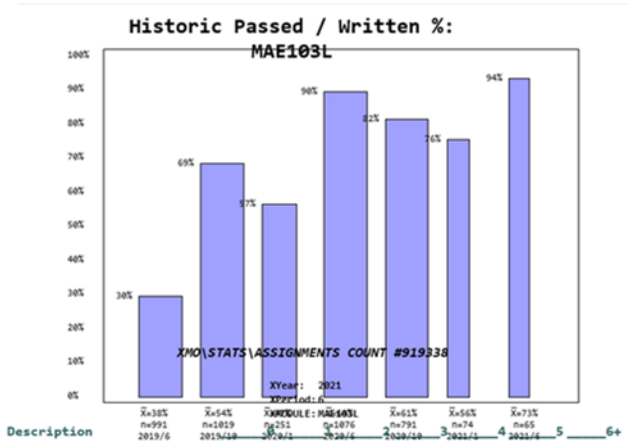
Outcomes and Impact

The adoption of WhatsApp significantly enhanced student engagement and academic performance. As depicted in Figure 2, the pass rate surged to 69% by the end of 2019 and continued to climb, reaching a peak of 94% in June 2021, (see Figure 4). This remarkable improvement led to the module being

removed from the at-risk list and established a new benchmark for success within the College of Education.

Figure 4

Performance in MAE103L between 2019 and 2021



The success of this strategy was not only reflected in the improved pass rates but also in the recognition I received from the Teaching and Learning Manager at the College of Education, which led to further opportunities to share this innovative approach through university-wide workshops and seminars (see Figures 1 and 5).

Figure 5

Increasing Visibility Online University level

EFFECTIVE TEACHING, LEARNING, STUDENT SUPPORT, ONLINE PRESENCE, BRANDING & SERVICE DELIVERY VIRTUAL WORKSHOP

PROGRAMME

PROGRAMME DIRECTOR: PROF. MD MAGANO

09:00-09:15	Welcome	Prof. ZT Motsa-Madikane VP: TLCESS
09:15-09:30	Setting the Context	Prof. MD Magano Acting ED: DTSFL
09:30-09:45	Customer Service and Its Implications in Teaching and Learning	Prof. K Makhitha
09:45-10:00	Navigating the LMS: Integrating Various Digital Tools in Teaching and Learning	Dr. P Makgato-Khunou (DISS) Ms. M Pooe (CDP) Dr. J Nene (CPD)
10:00-11:00	Being Visible Online: Improving Pass Rates in a Module *NB: Each speaker will be allocated 10 minutes*	Ms. C Van Zyl (CEMS) Ms. A Carrim (CEDU) Mr. M Ngoveni (CEDU)

Reflections on Group Dynamics

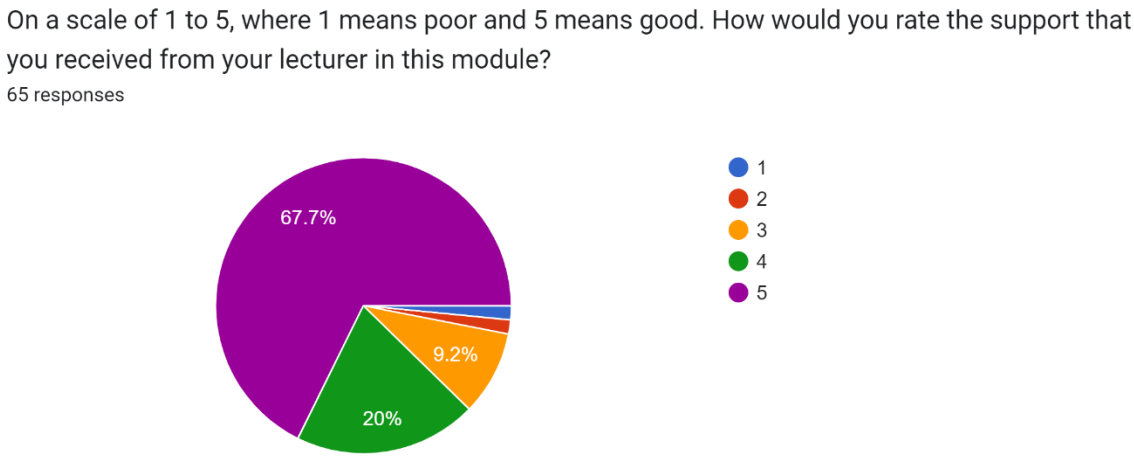
The strategy's effectiveness was largely due to the dynamic interaction within the WhatsApp groups. Students freely exchanged questions and solutions, which fostered a robust environment for knowledge sharing. This collaborative atmosphere was crucial in not only improving academic performance but also in building a supportive community that extended beyond traditional classroom boundaries.

After students completed their examination, I engaged them to evaluate their satisfaction with the provided strategies, focusing on overall satisfaction (see Figure 6). The response rate was lower than ideal, which is understandable given the timing since I requested this after they had written the examination. I sent out a Google Form link via email, and although many students do not regularly check their emails, I obtained responses from 65 students. The survey results showed that 68% of the students rated me 5 out of 5, 20% rated me 4 out of 5, 9% gave me 3 out of 5, and the remaining 3% rated me below 3.

This positive feedback is encouraging and indicates that the effort I invested in my students was appreciated.

Figure 6

Student satisfaction



Discussion

The MAE103L module at UNISA's use of WhatsApp significantly enhanced student outcomes, aligning with Social Learning Theory (SLT). Here's how specific findings from the study integrate with established literature:

Increase in Pass Rates

The dramatic increase in pass rates, from about 30% to 94% by mid-2021, highlights WhatsApp's effectiveness as an educational tool. This reflects broader educational research, showing that mobile platforms like WhatsApp can enhance learning by providing constant access to educational resources and peer support. Law et al. (2020) and Dobbins and Denton (2017) noted that instant access to educational materials via mobile platforms can significantly

aid in reinforcing learning and retaining concepts, crucial in complex subjects like mathematics.

Enhanced Engagement and Collaboration

WhatsApp facilitated dynamic interactions among students and instructors, crucial in an ODeL environment. According to Lee, Chern, and Azmir (2023), platforms that enhance peer support and foster academic discussions play a significant role in deepening students' understanding of the material and improving academic performance. This mirrors the enhanced collaboration observed in the MAE103 module, underscoring the platform's capability to foster a robust learning community.

Resource Distribution

The effective distribution of resources via WhatsApp supported continuous and flexible learning opportunities. This utility aligns with findings from Law et al. (2020), who stressed the role of mobile technologies in distributing educational materials, allowing students to access and review materials like lecture notes and quizzes anytime, which is particularly beneficial for complex subjects.

Observational Learning and Modeling

The ability to observe peer problem-solving methods in real-time within WhatsApp groups directly supports SLT's emphasis on observational learning. This aspect is highlighted in Alqahtani and Rajab's (2022) study, which found that WhatsApp facilitates improved understanding and retention of concepts through peer interaction and visible problem-solving processes.

Imitation and Reinforcement

The immediate feedback mechanism within WhatsApp reinforced positive learning behaviors quickly and efficiently. Nkambule (2023) emphasizes that

supplementary materials and support provided via WhatsApp lead to better performance, demonstrating how immediate feedback and reinforcement within WhatsApp groups can enhance academic performance.

Motivation

The supportive and interactive environment provided by WhatsApp significantly boosted students' motivation, aligning with Ryan and Deci's (2000) assertion that intrinsic motivation flourishes in environments that promote autonomy, competence, and relatedness.

Challenges and Considerations

Despite the positive outcomes, challenges such as the digital divide and data privacy concerns were significant. These issues reflect broader concerns in digital education, as noted by Brown & Czerniewicz (2010), who discuss how inequities in digital access can impact educational engagement. Managing large volumes of messages and minimizing distractions through clear guidelines and structured usage is essential to maximizing the platform's educational benefits, as noted by Jain (2019).

Recognition and Broader Implications

The external recognition and requests to present these strategies at educational forums underscore the success of the WhatsApp integration in achieving notable improvements in student performance. This validation echoes the broader educational impact discussed in the literature, where successful technology integration, especially those enhancing pedagogical practices, is often shared across educational communities. According to Bates (2020), such recognition not only serves as a testament to the efficacy of innovative practices but also fosters the dissemination of effective methods, encouraging their adoption in different settings. This concept is supported by Kirkwood and Price (2014), who highlight that disseminating best practices through scholarly

outlets and presentations can significantly contribute to the refinement and widespread adoption of these practices.

Conclusion

The integration of WhatsApp within the MAE103L module at UNISA not only aligns with but also enriches the theoretical framework provided by SLT. The external recognition of these practices further validates the effectiveness of this approach, encouraging its broader application and study within the educational technology community. This comprehensive analysis highlights the potential of mobile technologies to revolutionize educational practices, particularly in distance learning settings, by addressing traditional barriers to engagement and resource accessibility.

Recommendations

Encourage more dynamic and sustained interaction among students through structured activities within WhatsApp to maximize the educational benefits of the platform. Implement structured guidelines for managing group chats to prevent overwhelming message volumes and to maintain focus on educational objectives. Utilize WhatsApp's multimedia capabilities more effectively to share educational resources like video tutorials, diagrams, and quizzes that can enhance understanding of complex mathematical concepts.

Limitations

The study acknowledges the digital divide, which can limit the accessibility of WhatsApp for students with poor internet connectivity or a lack of technological devices.

Using WhatsApp raises data privacy issues that need to be addressed, considering that personal and potentially sensitive information is shared on the platform.

There is a significant need for structured teacher training on how to effectively use WhatsApp for educational purposes to maximize its benefits and mitigate distractions.

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