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Original Article

From Scroll to Solve: Leveraging Social Media for Mathematics Education in the Digital Age

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ABSTRACT

This study explored the role of social media in the teaching and learning of Mathematics among junior high school students and teachers in the Upper East Region of Ghana. Anchored in Mayer's Cognitive Theory of Multimedia Learning, the study adopted a mixed-methods approach and the sequential explanatory design. The study made use of a structured questionnaire and interview guide to gather data from the 150 students and 10 teachers who were sampled using the stratified random sampling technique. Permission was sought before conducting the study, and all ethical issues in research were adhered to. Findings from this study revealed that social media platforms such as WhatsApp, YouTube, and Telegram are commonly used to share educational content, facilitate discussions, and enhance conceptual understanding in Mathematics. Most students reported improved motivation, better comprehension, and the ability to learn at their own pace through multimedia materials accessed on social media. Teachers highlighted that the convenience of sharing video tutorials and assignments through social platforms is a good motivator to use such platforms for tutorials. However, several challenges, such as high data costs, distractions, and limited access to devices, especially those in rural areas, were reported. The study concludes that when used effectively, social media can serve as a powerful supplementary tool in Mathematics education. It recommends that educators receive training on digital pedagogy and that policies be implemented to reduce technological barriers.

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INTRODUCTION

The integration of technology into education has significantly reshaped teaching and learning experiences across disciplines, including Mathematics. Among the various technological advancements, social media has emerged as a dynamic platform that offers new avenues for educational engagement. Social media platforms such as WhatsApp, YouTube, Facebook, Telegram, and TikTok are increasingly being used to facilitate collaborative learning, share educational resources, and foster communication between teachers and students (Manca & Ranieri, 2016).

Mathematics education traditionally relies on classroom instruction, textbooks, and structured problem-solving activities. However, these methods often face challenges in sustaining student engagement, particularly when students perceive Mathematics as abstract or difficult (Boaler, 2016). In this context, social media presents an opportunity to enhance conceptual understanding by providing access to interactive content, peer discussion forums, tutorial videos, and real-time feedback mechanisms. Studies have shown that when used appropriately, social media can create a more student-centred learning environment and promote active participation in learning Mathematics (Al-Rahmi & Zeki, 2017).

Furthermore, the interactive and multimedia nature of social media platforms allows students to visualise complex mathematical concepts through videos, animations, and peer explanations, which can enhance comprehension and retention (Greenhow & Lewin, 2016). An example of such platforms is YouTube, which offers countless Mathematics tutorials that break down difficult topics into simpler, relatable explanations, while WhatsApp groups provide immediate support and resource sharing among students and teachers.

Despite its potential benefits, the use of social media in Mathematics education also presents several challenges. These include the risk of distraction, the variability in the quality of online educational content, issues of cyberbullying, and unequal access to digital devices and stable internet (Tess, 2013). Additionally, many educators express concerns about their digital literacy and the lack of formal training on integrating social media effectively into their teaching practices (Asterhan & Rosenberg, 2015).

In Ghana and other developing countries, the use of social media in education is still a relatively new phenomenon, with limited empirical studies focusing specifically on its impact on Mathematics education at the high school level. Understanding how social media can be leveraged to support Mathematics learning and the challenges involved is crucial to designing interventions that maximise its benefits while mitigating its drawbacks.

Given this backdrop, the present study seeks to explore how social media is being used by students and teachers in Mathematics education, its impact on student engagement and performance, and the perceived benefits and challenges associated with its use.

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Statement of the Problem

Mathematics education continues to face challenges related to student engagement, conceptual understanding, and academic performance, particularly in secondary schools. Traditional teaching methods, often characterised by rote memorisation and limited interactivity, have been criticised for failing to stimulate interest or deep learning among students (Boaler, 2016). With the widespread penetration of digital technologies, especially social media platforms, new opportunities for enhancing Mathematics teaching and learning have emerged. Social media tools such as WhatsApp, YouTube, Facebook, and Telegram are increasingly being adopted in educational contexts to promote collaboration, provide supplementary materials, and foster interactive learning environments (Manca & Ranieri, 2016; Greenhow & Lewin, 2016).

Despite this growing trend, there remains a significant gap in understanding how social media is specifically influencing Mathematics education, particularly in the context of developing countries like Ghana. Currently, studies predominantly focus on higher education or general education subjects, leaving a paucity of research centred on secondary-level Mathematics learning (Al-Rahmi & Zeki, 2017; Tess, 2013). Moreover, while social media offers potential benefits such as increased accessibility to diverse learning resources and enhanced peer-to-peer interaction, concerns about distractions, misinformation, and digital literacy among both students and teachers continue to persist (Asterhan & Rosenberg, 2015).

In Ghanaian secondary schools, where infrastructural and resource challenges are already pronounced, the integration of social media into educational practices remains largely informal and unstructured. Teachers often lack professional training on effective digital pedagogies, and students may not receive guidance on how to use social media productively for academic purposes (Boateng & Amankwah, 2019). Without empirical studies investigating these dynamics, educational stakeholders are limited in their ability to make informed decisions about leveraging social media to improve Mathematics learning outcomes.

Therefore, there is a pressing need to investigate how students and teachers are currently using social media in Mathematics education, the perceived benefits and challenges, and the overall impact on engagement and academic performance. Addressing this gap will not only contribute to the academic literature but will also provide practical insights for educators, policymakers, and technology developers aiming to optimise digital tools for Mathematics teaching and learning.

Purpose of the Study

The purpose of this study is to explore the role of social media in enhancing Mathematics education among secondary school students. Specifically, the study seeks to examine how students and teachers are utilising social media platforms to support the teaching and learning of Mathematics, to identify the perceived benefits and challenges associated with its use, and to assess the impact of social media on students' engagement and academic performance in Mathematics. The findings are expected to provide practical recommendations for integrating social media into Mathematics instruction to improve learning outcomes.

Research Objectives

The objective that guided the study was to find out;

- How social media is currently being used by students and teachers in the teaching and learning of mathematics.
- Students’ perceived benefits and challenges of using social media as a tool for Mathematics instruction.

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- The perception of teachers and students about the role of social media in enhancing conceptual understanding of Mathematics topics.

Research Questions

The following research questions guided the study:

- How is social media currently being used by students and teachers in the teaching and learning of Mathematics?
- What are students' perceived benefits and challenges of using social media as a tool for Mathematics instruction?
- How do teachers and students perceive the role of social media in enhancing conceptual understanding of Mathematics topics?

Significance of the Study

Practically, the study provides valuable insights into how social media can be effectively integrated into classroom instruction to enhance students' understanding and engagement with Mathematics, offering teachers innovative strategies to supplement traditional teaching methods. From a policy perspective, the findings can inform educational stakeholders and curriculum developers on the need to incorporate digital tools and social media into national teaching standards and ICT integration policies, especially in contexts with increasing digital penetration. In terms of literature, the study adds to the growing body of research on educational technology by specifically addressing the role of social media in Mathematics education, a relatively underexplored area, thereby serving as a reference point for future empirical investigations and theoretical developments.

LITERATURE REVIEW

Theoretical Review

The study was underpinned by the Richard E. Mayer's Cognitive Theory of Multimedia Learning (CTML) (2009) which posits that individuals learn more deeply from words and pictures than from words alone, based on the assumption that learners process multimedia information through dual channels (visual and auditory), have limited capacity in each channel, and engage in active learning to build mental representations. This theory has been pivotal in guiding the design of multimedia learning environments and has profound implications for social media usage in Mathematics education.

Social media platforms, particularly YouTube, WhatsApp, and Instagram, leverage multimedia tools such as videos, animations, infographics, and interactive quizzes that align well with Mayer's CTML principles. For instance, when Mathematics instruction is presented via short instructional videos that integrate narration (audio) and dynamic visuals (animations, diagrams), it satisfies Mayer's multimedia principle, which states that students learn better from a combination of words and images than from words alone (Mayer, 2009). This is supported by empirical studies such as those by Fiorella & Mayer (2015), which demonstrated improved retention and transfer of knowledge when multimedia elements are strategically combined.

The modality principle, which asserts that learners benefit when words are presented as narration rather than on-screen text, is particularly relevant to platforms like YouTube. Educational Math content on YouTube often utilises narration with animated visuals to explain algebraic and geometric concepts, matching students' preferences for self-paced, engaging content (Choi & Johnson, 2007). These principles are echoed in recent studies, which found that Mathematics learners exposed to multimedia content on social media displayed higher conceptual understanding and longer retention compared to those taught via text-based methods (Kay *et al.*, 2018).

Furthermore, Mayer's segmenting principle, which advocates breaking down information into user-paced segments, maps well onto the short-form content features of social media such as TikTok or

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Instagram Reels. While these platforms are not traditionally academic, educational influencers increasingly use them to deliver bite-sized Math tutorials. These allow learners to pause, replay, and revisit content as needed, promoting deeper cognitive processing and aligning with Mayer's self-regulation and pacing principles (Mayer & Moreno, 2003).

Social media also fosters social constructivist learning, complementing CTML through collaborative and peer-supported environments (Hrastinski & Aghaee, 2012). Students in WhatsApp or Facebook study groups often share videos, pose questions, or clarify misunderstandings using multimedia messages, engaging in both verbal and visual cognitive processing, which facilitates dual-channel learning. This aligns with the generative learning principle in CTML, where learners actively integrate new information with prior knowledge through explanation, elaboration, and organisation (Mayer, 2014).

However, critics warn that social media's cognitive benefits are not automatic. According to Mayer (2009), cognitive overload occurs when learners are presented with too much information or poorly designed multimedia elements, leading to reduced learning efficiency. This is a significant challenge on unregulated platforms where students may encounter distracting or inaccurate content. Lepp *et al.* (2015) note that non-instructional distractions prevalent on social media can interfere with the selective attention required for deep processing, especially in cognitively demanding subjects like Mathematics.

To mitigate such issues, Mayer's coherence and signaling principles, which emphasise eliminating extraneous material and highlighting essential content, are crucial in designing effective educational media. Thus, educators need to curate or create social media content that aligns with CTML guidelines to maximise cognitive gain and minimise cognitive load (Mayer, 2014).

Mayer's Cognitive Theory of Multimedia Learning provides a robust theoretical lens through which the integration of social media into Mathematics education can be evaluated. The theory supports the notion that well-designed multimedia content on social platforms can significantly enhance students' understanding of complex mathematical concepts through dual coding, active processing, and self-paced learning. However, these benefits depend on intentional instructional design and student media literacy. To fully harness social media's educational potential, Mathematics educators must align their practices with CTML principles while guiding students to navigate and evaluate multimedia content critically.

Utilisation of Social Media in Mathematics Education

The integration of social media into education has become increasingly common, particularly with the rise of digital learning environments. In the context of Mathematics education, social media platforms are being used by both students and teachers as tools to support teaching and learning activities. Teachers often use platforms like WhatsApp to send assignments, post video explanations, and maintain communication with students outside regular classroom hours (Barfi et al., 2021). WhatsApp groups have been found to enhance collaboration and provide a convenient channel for real-time discussion and clarification of mathematical problems.

YouTube is another widely used platform due to its extensive collection of educational videos, which allow students to learn complex mathematical concepts at their own pace (Biton & Segal, 2021). Many students prefer this method as it enables them to pause, rewind, and replay explanations, leading to better comprehension. In addition, some educators record and upload their tutorial videos, thereby extending their instructional influence beyond the physical classroom (Sharqi et al., 2016).

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Telegram and Facebook are also being explored for their utility in sharing educational content. Telegram allows for the distribution of large files and e-books, while Facebook facilitates academic discussions in closed groups (Biton & Segal, 2021). However, the extent of usage among teachers varies depending on digital literacy, institutional support, and access to resources (Alabdulkareem, 2015). While many educators see the benefits of these platforms, some still rely on traditional face-to-face methods due to a lack of training or infrastructure.

Perceived Benefits and Challenges of Social Media in Mathematics Instruction

Students generally perceive social media as an accessible and flexible tool that supports personalised learning. The primary benefit is the ability to access learning materials anytime and anywhere, which enhances independent study and self-paced learning. Platforms like YouTube and TikTok offer visual and auditory representations of mathematical concepts, making abstract ideas more tangible. According to Nursyam *et al.* (2024), students reported increased motivation to learn Mathematics when engaging with interactive and visually stimulating content via social media.

Another significant benefit is the opportunity for peer-to-peer support. In social media groups, students can ask questions, share solutions, and collaborate on assignments. This informal learning environment often reduces the anxiety associated with classroom participation and fosters a community of practice among learners (Biton & Segal, 2021).

Despite these benefits, there are notable challenges. One of the most common is the potential for distraction. Social media platforms are primarily entertainment-focused, and without proper discipline, students may spend more time on unrelated content (Alabdulkareem, 2015). Additionally, not all content shared on social media is accurate or pedagogically sound, leading to the risk of misinformation. Moreover, the digital divide remains a concern; student in low-resource settings may lack reliable internet access or devices, limiting their ability to fully participate in social media-based learning (Barfi et al., 2021).

Perceptions of Social Media's Role in Enhancing Conceptual Understanding

The use of social media in mathematics education has increasingly been recognised as a tool to support students' conceptual understanding of complex topics. Both students and teachers perceive that the visual and interactive features of platforms such as YouTube, TikTok, and Facebook can play a significant role in clarifying abstract mathematical ideas (Nursyam *et al.*, 2024). Video-based learning has been identified as an effective method for delivering step-by-step problem-solving processes and visual demonstrations that support deeper comprehension (Biton & Segal, 2021).

TikTok, for example, has gained popularity among younger learners due to its short, engaging videos, which can break down mathematical concepts into digestible segments. Math educators and influencers use creative visuals, storytelling, and humour to present topics such as algebra, trigonometry, and calculus in relatable ways (The Times, 2024). These formats often promote curiosity and a desire to explore topics further, helping students build foundational understanding outside the traditional classroom environment.

However, educators caution that while these tools are beneficial in reinforcing learning, they should be seen as supplementary rather than primary modes of instruction. David Thomas, a former mathematics teacher and digital education expert, argues that genuine conceptual understanding in mathematics is developed through rigorous practice, critical reflection, and the opportunity to engage in problem-solving processes, elements that are often lacking in brief, entertaining social media content (The Times, 2024). Furthermore, the passive nature of consuming videos without guided learning may limit a student's ability to apply concepts in varied

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contexts, a key component of mathematical literacy (Alabdulkareem, 2015).

Ultimately, while social media platforms offer a modern avenue for supporting mathematical instruction and engagement, their effectiveness depends on how they are integrated into broader pedagogical strategies. Teachers need to scaffold these resources appropriately and encourage students to use them as part of a reflective and structured learning journey.

METHODOLOGY

Research Approach and Design

This study adopted a mixed-methods research approach and the sequential explanatory design, combining both quantitative and qualitative approaches. This design is appropriate because it allows for a comprehensive understanding of how social media is used in Mathematics education, capturing both measurable trends and in-depth perceptions from students and teachers (Creswell & Plano Clark, 2018).

Population and Sampling

The target population for the study includes Mathematics teachers and senior high school students in selected schools within the Upper East Region of Ghana. A stratified random sampling technique was used to ensure representation across public and private schools, as well as urban and rural settings. From the population, a sample of approximately 10 Mathematics teachers and 150 students was selected for questionnaire administration. A subset of participants, 4 teachers and students, were purposefully chosen for interviews based on their experience with social media in Mathematics learning.

Data Collection Instruments

The study employed multiple instruments aligned with the research questions. A structured questionnaire and an interview guide were used to gather data for the study. The questionnaire was on a 5-point Likert scale (Strongly Disagree to Strongly Agree)

All instruments were validated by a panel of experts in Mathematics education and educational technology to ensure content validity. A pilot study was conducted to test reliability, especially for the Likert-scale items, using Cronbach's alpha. The results indicated a Cronbach's alpha value of 0.81, which, according to Stanley (2020), is deemed reliable.

Data Collection Procedures

Questionnaires were administered in person during school hours after permissions had been sought from the district director of education and the head teachers at the sampled schools. The purpose of the study was explained to the respondents, and they were allowed to withdraw from the study if they felt uncomfortable.

After the administration of the questionnaire, an interview was conducted for the sampled respondents, audio recording was done with the consent of the participants. The interview was conducted in English. Ethical considerations such as informed consent, anonymity, and confidentiality were strictly observed throughout the study.

Data Analysis Techniques

Data collected were analysed using Descriptive statistics (frequencies, means, percentages) for the quantitative part of the study and thematically analysed for the qualitative part of the study. Transcribed data were coded manually or with the help of software like NVivo to identify recurring themes.

Trustworthiness and Validity

To ensure the trustworthiness of qualitative data, the study employed triangulation by collecting data from multiple sources (students, teachers). Member checking was used to verify interpretations from

Article DOI: https://doi.org/10.37284/eajes.8.2.3217

interviews. Quantitative reliability was confirmed through pilot testing and reliability coefficients.

Ethical Considerations

Approval was sought from the relevant educational authorities and school administrators. Participation was voluntary, and all participants signed informed consent forms. Data was stored securely, and identities were anonymised in the final report.

RESULTS AND DISCUSSIONS

Research Questions One

How is social media currently being used by students and teachers in the teaching and learning of Mathematics?

Understanding how social media is currently being utilised in the teaching and learning of Mathematics is essential in evaluating its relevance and effectiveness in modern educational practices. With the widespread adoption of digital technologies, both students and teachers increasingly turn to social media platforms as supplementary tools for communication, collaboration, and content delivery. This research question seeks to explore the specific ways in which these platforms are being integrated into mathematics education and the extent of their usage among learners and educators.

Table 1: Social Media Usage by Students and Teachers in Mathematics Education

Platform	Student Usage f (%) (n=150	Teachers Using f(%) (n=10)
WhatsApp	128 (85.3)	8(80.0)
YouTube	108(72.0)	6(60.0)
Telegram	60(40.0)	2(20.0)
Facebook	40(26.7)	3(30.0)
Instagram	18 (12.0)	1(10.0)
TikTok	22	0 (0.0)

Results from the data presented in Table 1 reveal a high usage of WhatsApp (85.3%) and YouTube (72%) among students, with similar trends among teachers, where WhatsApp (80%) and YouTube (60%) are also dominant. This indicates that both groups perceive these platforms as effective for communicating mathematical ideas, sharing instructional content, and providing remote support.

The dominance of WhatsApp aligns with studies that highlight its popularity in education for creating real-time communication between students and teachers (Barhoumi, 2015). WhatsApp facilitates quick sharing of mathematical problems, solutions, and explanations, making it a useful supplement outside the formal classroom environment. YouTube serves as a visual learning platform, where students can access video tutorials, worked examples, and conceptual explanations, which support Mayer's (2009) Cognitive Theory of Multimedia Learning. Students benefit from repeated viewing and visual explanations, particularly in topics that are abstract or procedural.

The moderate use of Telegram (40% students; 20% teachers) and Facebook (26.7% students; 30% teachers) suggests that while these platforms are part of the digital learning ecosystem, they are less preferred, possibly due to lower engagement or institutional restrictions. Telegram, though similar to WhatsApp, may not be as widely adopted due to accessibility and network effects. Facebook, often considered a social rather than educational tool, may pose distractions, which could account for its lower adoption for academic purposes.

Platforms like Instagram (12%) and TikTok (14.7%) are used by a small fraction of students,

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with virtually no use among teachers. These platforms are typically associated with entertainment rather than formal learning. However, their growing popularity among youth suggests untapped potential. As Kimmons *et al.* (2020) point out, educational content adapted for these platforms could increase engagement if designed appropriately.

From the teachers' side, the adoption of social media reflects a willingness to integrate technology into teaching practices, albeit with caution and variability. The data show a digital divide in platform preference and technological fluency, with only 60% of teachers using YouTube and a minimal presence on newer platforms. This supports findings by Trust (2017), who emphasised that while teachers recognise the value of social media in professional practice, adoption often depends on training, confidence, and institutional support.

The analysis indicates that social media is increasingly embedded in Mathematics education, particularly through WhatsApp and YouTube, which support communication and visual learning. While other platforms have limited usage, their educational potential remains significant if properly harnessed. These findings underline the importance of digital literacy training for teachers and the need to reimagine social media as a legitimate instructional resource, echoing recommendations from Greenhow & Lewin (2016).

Interview Responses

Student Responses:

> **Student 1:** *"As for me, I use YouTube a lot when it comes to learning Mathematics. Some channels on YouTube break down the topics very well, and I can pause and replay the explanations as many times as I want. It helps me understand topics better, especially algebra and geometry."*
>
> **Student 2:** *"We have a class WhatsApp group where our Maths teacher sends questions, and we sometimes discuss answers. During exam periods, he sends short video solutions too. It helps me stay connected and revise topics at home."*
>
> **Student 3:** *"I follow some educational pages on Facebook and Instagram. Although they don't post regularly, the Maths tips and sample questions I see there have helped me. I also use Telegram to download solved past questions."*

The responses from the three students illustrate the diverse and purposeful use of social media platforms to support Mathematics learning. Several key themes emerge:

YouTube as a Tool for Visual and Independent Learning

Student 1 highlights YouTube's value in visual learning, noting the ability to pause, replay, and choose content that suits her learning pace. This aligns with the Cognitive Theory of Multimedia Learning (Mayer, 2009), which emphasises the role of dual channels (visual and auditory) in enhancing comprehension. Students benefit from seeing worked examples, especially in abstract areas like algebra and geometry, reinforcing the idea that YouTube fosters self-paced, concept-based understanding.

WhatsApp for Collaborative and Supplementary Learning

Student 2's response reflects how WhatsApp functions as a collaborative platform for ongoing teacher-student interaction beyond the classroom. It serves as a digital space for sharing practice questions, video explanations, and peer discussion. This practice supports Vygotsky's Social Constructivist Theory, where learning is enhanced through interaction and scaffolding within a community. The use of WhatsApp during exam preparation also indicates its role in reinforcing learning and promoting revision.

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Facebook, Instagram, and Telegram for Informal Supplementary Learning

Student 3 demonstrates how platforms like Facebook and Instagram, typically viewed as informal or entertainment platforms, can still contribute to academic support by providing short tips, motivational content, and practice questions. Even though these platforms are not educationally structured, students selectively use them for Mathematics enrichment. Telegram is used for accessing past questions and materials, showcasing how students leverage available content repositories to revise and practice, reflecting increasing student autonomy in seeking resources.

The student responses reveal that social media is used in complementary ways to support formal classroom instruction in Mathematics. While YouTube and WhatsApp are central due to their educational design and communication features, platforms like Facebook, Instagram, and Telegram offer informal yet useful learning inputs. These insights affirm that social media, when intentionally used, supports differentiated learning styles, enhances student motivation, and extends learning opportunities beyond the classroom (Greenhow & Lewin, 2016). It also suggests a growing trend of student-led digital learning, which policymakers and educators can harness to redesign digital learning strategies in Mathematics.

Teacher Responses

> **Teacher 1:** *" As for me, I have created a WhatsApp group for my class. It allows me to send assignments, explain some concepts, and share educational videos or links. It's a very useful way to reach students, especially when they are not physically in school, like during holidays or absences."*
>
> **Teacher 2:** *"I mostly use YouTube to share content with students. Sometimes I record my own short videos solving equations or explaining graphs and post them on WhatsApp. It's easier than waiting for the next class to clarify doubts."*
>
> **Teacher 3:** *"I occasionally use Telegram to post Maths materials in a subject-specific group with other teachers. We also share helpful resources that students can use. Although I don't use social media daily for teaching, it's becoming an important tool."*

WhatsApp as a Tool for Direct Instruction and Communication

Teacher 1 highlights the use of WhatsApp for sending assignments, explaining concepts, and sharing educational videos or links. This demonstrates that WhatsApp is functioning as an informal learning management system, offering flexible communication outside the classroom. The practice aligns with research by Bouhnik & Deshen (2014), who found that WhatsApp supports blended learning and increases teacher-student engagement.

YouTube and WhatsApp for Video-Based Learning

Teacher 2 leverages YouTube to deliver recorded Mathematics lessons and shares them via WhatsApp. This combines asynchronous learning (YouTube) with direct outreach (WhatsApp). The use of teacher-generated videos promotes personalised instruction and supports Mayer's Multimedia Learning Theory, which suggests that combining verbal and visual materials improves student understanding.

Telegram for Peer Collaboration and Resource Sharing

Teacher 3 uses Telegram more for professional networking among Mathematics educators, sharing materials that can support teaching and learning. While not student-focused, this indicates that social media supports teacher professional development and content curation, echoing Wenger's Communities of Practice theory (1998), where knowledge sharing enhances practice.

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Teachers are creatively using platforms like WhatsApp, YouTube, and Telegram to extend the learning environment, provide on-demand explanations, and collaborate professionally. The findings indicate a shift toward blended and connected teaching models in Mathematics education, aligning with global trends in digital pedagogy.

Research Question Two

What are students' perceived benefits and challenges of using social media as a tool for Mathematics instruction?

As social media becomes more embedded in educational settings, it is important to understand students' perceptions of its usefulness and limitations. While many students report increased engagement and access to diverse learning resources, others may experience distractions or information overload. This research aims to uncover the perceived advantages and barriers that students associate with using social media for learning mathematics, offering insight into how these tools can be optimised for effective instruction.

Table 2: Perceived Benefits of Using Social Media

Benefit	Mean Score	Std. Dev
Makes learning interesting	4.2	0.70
Improves understanding	4.1	0.80
Reduces anxiety	3.8	0.90
Self-paced learning	3.9	0.85

The data in Table 2 suggests that students and teachers perceive social media as a valuable educational tool in Mathematics, particularly in making learning more engaging and enhancing understanding. The highest-rated benefit was that social media makes learning interesting, with a mean score of 4.2 and a relatively low standard deviation of 0.70, indicating strong agreement among respondents. This supports findings by Junco (2012), who observed that the integration of social media in educational settings significantly increases student engagement, participation, and enthusiasm toward learning tasks.

Additionally, the statement that social media improves understanding recorded a mean score of 4.1, suggesting that learners find digital content, especially visual aids, step-by-step videos, and interactive discussions, helpful in grasping complex mathematical concepts. This aligns with Mayer's (2009) Cognitive Theory of Multimedia Learning, which posits that students learn more effectively when instructional material is presented using both words and visuals. Platforms like YouTube and TikTok, which combine audio-visual content, offer learners a multimodal environment that supports deeper conceptual understanding.

The benefit of self-paced learning also received a high mean of 3.9, indicating that many students appreciate the flexibility social media provides, allowing them to review content as needed and learn at their own pace. This reflects findings by Hrastinski (2008), who emphasised that asynchronous online tools empower learners to take control of their learning process, thereby enhancing autonomy and knowledge retention.

However, the perception that social media reduces anxiety was rated lower, with a mean of 3.8 and a standard deviation of 0.90, showing more variability in responses. While some students may feel more comfortable learning in informal settings and revisiting materials at their own pace, others may still experience anxiety due to the lack of real-time feedback or distractions associated with social media. As suggested by Ramirez & Zhang (2013), while digital platforms can support reduced performance pressure, their effectiveness in

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lowering Mathematics anxiety may depend on how structured and supportive the content delivery is.

Table 3: Perceived Challenges of Using Social Media

Challenge	Affected Students	Percentage
High data cost	98	65.3%
Distractions	75	50.0%
Device access issues	52	34.7%
Unreliable content	30	20.0%

Table 3 reveals several key challenges associated with the use of social media for teaching and learning Mathematics, with high data cost emerging as the most significant barrier. A total of 98 students (65.3%) reported that high internet or data costs limit their ability to consistently engage with educational content on platforms such as YouTube or Telegram. This finding reflects the broader concern in low- and middle-income countries, where limited access to affordable internet hampers the effectiveness of digital learning tools (UNESCO, 2020). In contexts like Ghana, where many students rely on mobile data, cost remains a major obstacle to fully leveraging the benefits of social media in education.

Distractions were reported by 75 students (50.0%), indicating that half of the respondents find it difficult to maintain focus when using social media for learning. This aligns with the concerns raised by Ophir *et al*. (2009), who noted that multitasking and constant notifications inherent in social media platforms can impede concentration and reduce academic performance. For subjects like Mathematics, which often require sustained cognitive effort and deep focus, the distraction risk can significantly undermine learning outcomes.

Another notable challenge is device access issues, reported by 52 students (34.7%). This suggests that over a third of the sample population face difficulties due to the lack of personal smartphones, tablets, or laptops, or because of shared or limited-use devices at home. This digital divide has been widely discussed in the literature, with Warschauer (2004) emphasising that unequal access to digital tools deepens educational inequities, particularly in resource-constrained settings.

Lastly, unreliable content was cited by 30 students (20.0%), pointing to concerns over the credibility and accuracy of educational material found on social media. Unlike formal learning platforms, social media often lacks content regulation, leading to the spread of misinformation or poorly explained concepts. This issue has been underlined by Greenhow & Lewin (2016), who argue that while social media can democratize access to knowledge, its unregulated nature requires learners and educators to be cautious and discerning consumers of information.

Research Question Three

How do teachers and students perceive the role of social media in enhancing conceptual understanding of Mathematics topics?

Conceptual understanding is a critical component of mathematics learning, requiring deep comprehension rather than rote memorisation. Social media offers unique advantages, such as videos, interactive visuals, and peer discussion, which may support this kind of learning. This research question explores the views of both teachers and students regarding the extent to which social media contributes to a clearer understanding of mathematical concepts and whether it serves as a meaningful complement to traditional instructional methods.

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Table 4: Perceived Role of Social Media in Enhancing Conceptual Understanding

STATEMENT	SD (%)	D (%)	N (%)	A (%)	SA (%)	$\bar{x}$ (std)
Social media enhances my understanding of Mathematics concepts	3 (2.0)	5 (3.3)	10 (6.7)	60 (40.0)	72 (48.0)	4.28 (0.87)
I understand Mathematics topics better when explained through video or visual demonstrations on social media.	2 (1.3)	4 (2.7)	9 (6.0)	55 (36.7)	80 (53.3)	4.37 (0.81)
Social media allows me to learn Mathematics at my own pace.	4 (2.7)	6 (4.0)	15 (10.0)	65 (43.3)	60 (40.0)	4.14 (0.92)
I use social media to revisit Mathematics concepts I didn't understand in class.	5 (3.3)	8 (5.3)	18 (12.0)	62 (41.3)	57 (38.0)	4.06 (0.99)
Social media provides multiple ways (video, audio, chat) to understand a concept.	3 (2.0)	4 (2.7)	12 (8.0)	58 (38.7)	73 (48.7)	4.29 (0.85)

The data presented in Table 3 highlights the primary challenges students face when using social media for mathematics learning. The most frequently cited challenge was high data cost, affecting 98 out of 150 students (65.3%). This underscores the economic barrier many students face in accessing internet-based learning resources. According to Ojo & Bello (2021), financial constraints such as the cost of mobile data and internet subscriptions remain a significant limitation to the integration of digital learning tools in many African educational contexts. This finding is particularly critical in low-income settings where students often depend on mobile devices and personal data bundles for connectivity.

Distractions emerged as the second most reported challenge, with 75 students (50.0%) indicating that social media often diverts their attention from academic activities. This aligns with prior findings by Junco (2012), who emphasised that while social media can support learning, it can also serve as a source of cognitive overload and decreased academic focus due to the presence of non-academic content. The competing nature of educational and entertainment content on social platforms often leads students to multitask or lose concentration, ultimately diminishing the effectiveness of social media as a learning tool.

The lack of access to devices, reported by 52 students (34.7%), further reflects a digital divide that disadvantages students who may not own smartphones or reliable devices capable of supporting educational media. As highlighted by UNESCO (2020), equitable access to ICT tools is a prerequisite for the success of any technology-mediated educational strategy. Students who lack access to suitable devices are often excluded from the full benefits of digital learning.

Lastly, unreliable content was noted by 30 students (20.0%) as a challenge, indicating concerns over the credibility and academic value of materials found on social media. This is consistent with the argument by Alexander *et al.* (2019) that the open nature of social media means content is not always vetted, and learners may struggle to distinguish between reliable educational resources and misinformation. This points to the need for media literacy and guidance from educators in navigating online educational spaces effectively.

Collectively, these findings indicate that while social media has potential benefits in mathematics education, its utility is hampered by socio-economic and pedagogical challenges. Addressing these issues requires a multifaceted approach that includes reducing the cost of access, improving digital infrastructure, and enhancing students' capacity to use social media responsibly for academic purposes.

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KEY FINDINGS, CONCLUSION, AND RECOMMENDATIONS

Key findings

- The study revealed that teachers are actively integrating social media platforms, particularly WhatsApp, YouTube, and Telegram, into their teaching of Mathematics. WhatsApp is used for direct communication, sharing assignments, and sending explanatory videos, while YouTube allows teachers to deliver personalised, video-based instruction. Telegram serves as a professional collaboration tool among teachers for resource sharing. This demonstrates that teachers are not only using social media to enhance student understanding but also to support peer learning and professional development, making social media a multifaceted educational tool.

- The findings reveal a dual reality in the use of social media for mathematics education. On one hand, social media is perceived as a valuable tool that makes learning more engaging, enhances understanding, supports self-paced learning, and reduces anxiety associated with traditional learning methods. On the other hand, students face notable challenges, the most critical being high data costs, distractions, and limited access to digital devices. These challenges pose a significant barrier to the effective integration of social media in mathematics instruction. This duality suggests that while the potential of social media in enhancing mathematics education is widely recognised, practical constraints hinder its optimal use.

- The study shows that the pedagogical promise of social-media-based mathematics learning is heavily constrained by structural barriers. The findings echo earlier work, noting that prohibitive internet costs and device scarcity remain the most salient impediments to digital learning in many parts of sub-Saharan Africa (Ojo & Bello, 2021; UNESCO, 2020).

CONCLUSION

It can be concluded that social media is playing a growing role in Mathematics education by extending learning beyond the traditional classroom. Teachers are leveraging different platforms based on their strengths, instant messaging for communication, video platforms for visual instruction, and forums for collaboration. These practices are making Mathematics more accessible and engaging for students and allowing teachers to deliver support in a flexible, timely manner. The use of social media aligns with modern pedagogical trends that emphasise blended learning, accessibility, and learner-centred approaches.

Social media presents both promises and pitfalls in mathematics education. The positive perception of its pedagogical value highlights its potential to transform the learning experience, making it more interactive, accessible, and learner-centred. However, socio-economic barriers such as internet costs, limited access to devices, and the risk of digital distractions limit the equitable and efficient use of social media tools. Therefore, for social media to be a sustainable educational solution, these structural challenges must be addressed. The study underscores the need for an enabling environment where students not only have access to digital tools but also guidance on how to use them effectively for academic purposes.

Finally, the findings indicate that although learners recognise the value of social media for making mathematics more engaging, their ability to capitalise on that value is curtailed by affordability, access, and quality-control issues. In contexts where mobile data and hardware remain expensive and unevenly distributed, social media risks widening, rather than narrowing, existing educational inequities. Unless these socio-economic and pedagogical hurdles are addressed, the substantial benefits identified in earlier analyses, enhanced

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interest, deeper conceptual understanding, and flexible, self-paced learning, are unlikely to be realised at scale.

Recommendations

- It is recommended that educational institutions formally recognise and support the integration of social media into Mathematics instruction by providing training, guidelines, and resources for teachers. Professional development workshops can help educators effectively use these platforms while maintaining academic integrity and data privacy. Additionally, policies should be developed to encourage responsible use of social media for educational purposes, ensuring that both students and teachers benefit from the flexibility and accessibility these tools offer.
- It is recommended that education stakeholders, including school administrators, policymakers, and ICT ministries, collaborate to implement supportive policies such as subsidised educational data packages, provision of digital learning devices, and teacher training on digital literacy. Schools should also incorporate digital media literacy into the curriculum to help students manage distractions and evaluate content reliability. Additionally, teachers should be encouraged to curate and recommend quality educational content on platforms like YouTube, WhatsApp, and Telegram to ensure students are guided toward credible resources. By addressing the infrastructure and pedagogical challenges, the educational benefits of social media in mathematics learning can be fully realised.
- To unlock the full educational potential of social media, stakeholders should pursue a three-pronged strategy, thus partner with telecom providers to offer subsidized or zero-rated data bundles for vetted educational platforms and expand school or community Wi-Fi zones; introduce device-lending schemes and public private initiatives to equip disadvantaged students with basic smartphones or tablets; and also provide teachers with professional-development workshops on curating trustworthy mathematics content and embed digital-media-literacy modules in the curriculum so students learn to manage distractions and evaluate information critically. Implementing these measures will mitigate the identified challenges and allow social media to function as an equitable and effective complement to traditional mathematics instruction.

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