Journal of Mathematics Instruction, Social Research and Opinion
Vol. 5, No. 3, September 2026, pp. 2025 – 2034, https://doi.org/10.58421/misro.v5i3.869
ISSN 2962-7842 2025

The Influence of Social Media on Students' Mathematical Communication Skills in Mathematics Learning

Machrani Adi Putri Siregar[1], Izwita Dewi[2], Hamidah Nasution[3]
[1]State Islamic University of North Sumatra, North Sumatera, Indonesia
[2,3]State University of Medan, North Sumatera, Indonesia

Article Info

Article history:

Received 2025-12-11
Revised 2026-07-07
Received 2026-07-09

Keywords:

Digital literacy of students
Learning mathematics
Mathematical communication
Social networks

ABSTRACT

This study aims to analyze the effect of social media use on students' mathematical communication skills. It employs a quantitative approach with a quasi-experimental design (*non-equivalent control group design*). The sample consisted of 60 eighth-grade students, divided into an experimental group and a control group. The experimental group received social media-assisted mathematics learning, while the control group received traditional instruction. The research instruments included a questionnaire on social media use and a mathematical communication skills test. The questionnaire used a 1-to-5 Likert scale, while the mathematical communication skills test was assessed using a rating scale with scores categorized into three levels: high, medium, and low, defined by intervals of values. Data analysis was performed using simple linear regression and a comparison of means between the two groups. This analysis was conducted using SPSS software. The results showed a significant difference in average mathematical communication skills between the experimental ($M = 79{,}43$)and control groups ($M = 70{,}21$). Inferential analysis revealed that social media use had a significant effect on students' mathematical communication skills. ($p = 0{,}001$). Furthermore, regression analysis showed that social media use contributed 27.4% to the development of students' mathematical communication skills, with the remainder influenced by other factors external to the study. These results indicate that social media can be a promising pedagogical tool for improving mathematical communication skills through interaction, collaboration, and the interactive exchange of information. Therefore, integrating social media into mathematics learning could create a more communicative and participatory learning environment.

Corresponding author:

Machrani Adi Putri Siregar
Faculty of Education and Teacher Training, State Islamic University of North Sumatra
Email: machraniadiputri@uinsu.ac.id

1. INTRODUCTION

The development of digital technologies has profoundly transformed education, particularly how students communicate, interact, and access information. Social networks, initially used primarily for entertainment and informal exchanges, have become an easily accessible learning platform. According to Greenhow and Lewin [1], social networks offer considerable potential as participatory platforms, allowing students to contribute, interact, and collaborate throughout their learning. In mathematics education, this transformation is particularly relevant because mathematical learning not only requires students to understand concepts but also to communicate, discuss, and justify their mathematical thinking. Therefore, the integration of digital platforms into mathematics learning provides new opportunities to create learning environments that are more interactive, collaborative, and responsive to students' digital habits [2], [3], [4], [5], [6].

Mathematical communication is one of the essential competencies that students need to develop in mathematics learning. The NCTM [7] emphasizes the importance of communication as a standard of mathematical process, enabling students to formulate, express, and reflect on mathematical concepts. Mathematical communication encompasses not only writing procedures but also explaining reasoning, constructing logical arguments, interpreting mathematical representations, and presenting mathematical ideas clearly. Baroody [8] argues that mathematical communication allows students to deepen their understanding through the systematic expression and discussion of ideas. Thus, students' ability to communicate mathematically becomes an important indicator of meaningful mathematics learning, because it reflects how students organize their thinking, connect concepts, and convey mathematical arguments.

However, in practice, many students still struggle to communicate mathematical ideas clearly and coherently. This difficulty may stem from low mathematical literacy, limited discussion opportunities, and learning models that do not provide sufficient space for students to explain their reasoning. Hiebert and Wearne [9] and Aryani and Rachmawati [10] argue that students need a learning environment that encourages exploration, discussion, and reflection for mathematical communication to develop optimally. In many traditional mathematics classrooms, students tend to focus on obtaining final answers rather than explaining the reasoning process behind those answers. As a result, students may be able to perform calculations, but they often face difficulties when asked to represent ideas, justify solutions, or communicate mathematical relationships using appropriate language, symbols, tables, graphs, or visual representations.

In this study, social media use is understood as the set of activities undertaken by students using digital platforms for learning purposes, including frequency of use, intensity of academic interactions, sharing of information or educational resources, and participation in online discussions related to mathematics. This use can take place via various platforms such as WhatsApp, YouTube, Instagram, and educational TikTok, which allow for rapid and interactive communication, collaboration, and information sharing [11], [12], [13]. From a social constructivist perspective, learning develops through interaction, dialogue, and the exchange of ideas. Therefore, social media has the potential to support mathematical

communication by providing spaces where students can discuss mathematical problems, ask questions, respond to peers' ideas, and receive feedback from teachers or classmates. First, it provides a discussion space where students can express mathematical ideas both in writing and orally through comments, messages, and forums. Second, visual elements such as images, infographics, videos, and animations can help students represent mathematical concepts in various forms. Third, ongoing interactions allow students to receive feedback from their peers and teachers, thereby improving and clarifying their mathematical reasoning. These features may encourage students to express mathematical thinking more actively, flexibly, and creatively than in conventional classroom settings.

Several previous studies have demonstrated that digital and social media can promote mathematics learning, particularly by improving students' mathematical communication skills. Prasetyo and Firmansyah [11] found that using TikTok in mathematics learning was positively correlated with students' ability to communicate mathematical ideas through visual representations and appropriate mathematical language. Similarly, Nurdiansyah and Marcharis [14] showed that digital learning materials can improve mathematical communication skills through more interactive and visual presentations of concepts. Furthermore, Haeruman et al. [15] revealed that platforms such as Instagram and GeoGebra can help students better understand mathematical concepts, thus promoting mathematical communication. Mayowi and Maarif [16] also emphasized that social interactions in learning influence students' mathematical communication skills, with discussions and exchanges among students being important factors in building mathematical understanding. Other studies have also shown that social media can increase student engagement, motivation, collaboration, and participation because it offers flexible interaction that is familiar to the digital generation [17], [18]. However, many of these studies still emphasize affective and social aspects of learning, such as engagement, motivation, and participation. In addition, studies on mathematics learning often discuss digital media in general, while the specific role of social media-assisted learning in developing students' mathematical communication skills has not been examined in a sufficiently structured way.

Based on this gap, this study focuses specifically on the influence of social media use on students' mathematical communication skills in mathematics learning. Unlike previous studies that mainly examined students' engagement or the use of digital media in general, this study investigates social media as a learning support tool that facilitates discussion, representation, feedback, and mathematical explanation. Therefore, this study aims to analyze the influence of social media use on students' mathematical communication skills. More specifically, it seeks to answer the following research question: "Does social media use significantly influence students' mathematical communication skills?" The hypothesis proposed in this study is that social media use has a positive and significant influence on students' mathematical communication skills. The findings of this study are expected to contribute to the development of digital learning strategies in mathematics education and to provide practical references for teachers in integrating social media into mathematics learning in a more structured, communicative, and participatory manner.

2. METHOD

2.1. Research Design

This study employed a quantitative approach using a quasi-experimental design with a non-equivalent control group design. This design was selected because the participants were already organized into existing classes, so random assignment of individual students was not possible. The study involved two groups: an experimental group and a control group. The experimental group received mathematics learning assisted by social media, whereas the control group received conventional mathematics instruction without the use of social media.

Both groups were taught the same mathematics topic over four instructional sessions. The difference between the two groups was the learning treatment. In the experimental group, social media was used to support discussion, information sharing, feedback, and the representation of mathematical ideas. Meanwhile, the control group learned through teacher explanation, classroom discussion, and written exercises without social media-based activities. At the end of the treatment, students' mathematical communication skills were measured using a written test.

2.2. Participants and Sampling Technique

The participants of this study were eighth-grade students at a public junior high school in Indonesia. The population consisted of all eighth-grade students in the selected school. The sampling technique used was cluster sampling, in which intact classes were selected as research samples.

Two classes were selected as the sample of the study. One class was assigned as the experimental group, while the other class was assigned as the control group. The total number of participants was 60 students, consisting of 30 students in the experimental group and 30 students in the control group. This sampling technique was considered appropriate because the study was conducted in a natural classroom setting without changing the existing class structure.

2.3. Treatment Procedure

The treatment was implemented over four learning sessions. In the experimental group, mathematics learning was supported by social media-based activities. Students used social media as a medium to access learning materials, discuss mathematical problems, share ideas, respond to questions, and receive feedback from peers and the teacher. The activities encouraged students to explain problem-solving steps, present mathematical representations, and communicate their reasoning through written explanations, images, comments, or other interactive features.

In the control group, students received conventional instruction. The teacher delivered the material through direct explanation, examples, classroom discussion, and individual or group exercises. Students completed the same learning materials as the experimental group, but without the integration of social media. This procedure was intended to ensure that the difference between the two groups was based on the use of social media as a learning support tool.

2.4. Research Instruments

Two instruments were used in this study: a social media usage questionnaire and a mathematical communication skills test. The social media usage questionnaire was developed based on indicators of digital literacy and social media use for academic purposes, adapted from Aesaert and van Braak [19]. The questionnaire consisted of four indicators: intensity of use, academic activity, quality of interaction, and perceived usefulness. The questionnaire used a five-point Likert scale, ranging from strongly disagree to agree strongly. Before being used in the study, the questionnaire was reviewed and validated by experts to ensure the relevance of the items to the research variables.

The mathematical communication skills test was a written test designed to measure students' ability to communicate mathematical ideas. The test was developed based on indicators of mathematical communication adapted from NCTM [7], namely: the ability to express mathematical ideas in written form, the ability to explain problem-solving procedures, and the ability to represent mathematical concepts using symbols, tables, graphs, or other mathematical representations. Students' answers were assessed using a scoring rubric based on the clarity, accuracy, completeness, and appropriateness of mathematical communication.

The reliability of the instrument was tested using Cronbach's alpha coefficient. The reliability coefficient obtained was 0.82, indicating that the instrument had a high level of reliability and was suitable for use in the study.

2.5. Data Collection Procedure

The data collection procedure consisted of four stages. First, the preparation stage included the development of research instruments, expert validation, revision of instruments, and coordination with the school. Second, the implementation stage involved the delivery of mathematics learning over four sessions in both groups. The experimental group received social media-assisted mathematics learning, while the control group received conventional instruction.

Third, the evaluation stage was conducted by administering the mathematical communication skills test to both groups after the treatment had been completed. Fourth, students in the experimental group completed the social media usage questionnaire to provide data on their use of social media during the learning process. All data were then collected, scored, and prepared for statistical analysis.

2.6. Data Analysis Technique

The data were analyzed using descriptive and inferential statistics with the assistance of SPSS software. Descriptive statistics were used to describe the distribution of students' scores, including mean, standard deviation, minimum score, and maximum score. The results of the descriptive analysis were used to compare the general performance of students in the experimental and control groups.

Before conducting inferential analysis, assumption tests were performed, including the normality test, homogeneity test, and linearity test. The normality test was used to determine whether the data were normally distributed. The homogeneity test was used to

examine whether the variance between the experimental and control groups was homogeneous. The linearity test was conducted to ensure that the relationship between social media use and mathematical communication skills was linear.

An independent sample t-test was used to determine whether there was a significant difference in mathematical communication skills between students in the experimental group and those in the control group. In addition, simple linear regression analysis was used to examine the influence of social media use on students' mathematical communication skills. The level of significance used in this study was 0.05. The regression analysis was also used to determine the contribution of social media use to students' mathematical communication skills, as indicated by the coefficient of determination.

3. RESULTS AND DISCUSSION

3.1. Results

Descriptive Statistics

This study involved 60 eighth-grade students, consisting of 30 students in the experimental group and 30 students in the control group. Descriptive analysis was conducted to describe students' mathematical communication skills after the learning treatment. The results showed that students in the experimental group obtained a higher mean score in mathematical communication skills than students in the control group. The mean score of the experimental group was 79.43, while the mean score of the control group was 70.21.

This result indicates that students who participated in social media-assisted mathematics learning demonstrated better mathematical communication skills than those who received conventional instruction. In addition, the mean score of students' social media use was 3.97, which was categorized as high. This finding suggests that students in the experimental group actively used social media for academic interaction, discussion, information sharing, and learning-related activities.

Table 1. Descriptive Statistics of Mathematical Communication Skills

Group	N	Mean
Experimental Group	30	79.43
Control Group	30	70.21
Social Media Use	30	3.97

Assumption Testing

Before conducting inferential statistical analysis, several assumption tests were performed, including normality, homogeneity, and linearity tests. The normality test using the Kolmogorov-Smirnov test showed that the data were normally distributed, as the significance value was greater than 0.05. The homogeneity test using Levene's test also showed that the variance between the experimental and control groups was homogeneous, with a significance value greater than 0.05.

Furthermore, the linearity test showed that the relationship between social media use and students' mathematical communication skills was linear. This result indicates that the data met the assumptions required for further parametric analysis.

Table 2. Results of Assumption Tests

Assumption Test	Statistical Test	Sig. Value	Decision
Normality	Kolmogorov-Smirnov	> 0.05	Normally distributed
Homogeneity	Levene's Test	> 0.05	Homogeneous variance
Linearity	Linearity Test	< 0.05	Linear relationship

Regression Analysis

Simple linear regression analysis was conducted to examine the influence of social media use on students' mathematical communication skills. The results showed that social media use had a positive and significant effect on students' mathematical communication skills. The standardized regression coefficient was $\beta = 0.524$, with a significance value of $p = 0.001$. Since the significance value was lower than 0.05, the hypothesis stating that social media use has a positive and significant influence on students' mathematical communication skills was accepted.

The coefficient of determination showed an R^2 value of 0.274. This means that social media use explained 27.4% of the variance in students' mathematical communication skills. In comparison, the remaining 72.6% was influenced by other factors not examined in this study, such as students' prior mathematical ability, learning motivation, teacher feedback, classroom interaction, and students' digital literacy.

Table 3. Results of Simple Linear Regression Analysis

Variable	β	R^2	Sig.	Interpretation
Social Media use → Mathematical Communication Skills	0.524	0.274	0.001	Significant positive effect

Thus, the findings indicate that the use of social media in mathematics learning can contribute positively to students' mathematical communication skills. Social media provides opportunities for students to discuss mathematical problems, share representations, receive feedback, and express their reasoning in more interactive and flexible ways.

3.2. Discussion

The findings of this study indicate that students who participated in social media-assisted mathematics learning obtained higher mathematical communication scores than those who received conventional instruction. This result suggests that the integration of social media into mathematics learning can provide students with more opportunities to express mathematical ideas, explain problem-solving procedures, and use various forms of mathematical representation. In addition, the regression result showed that social media use had a positive and significant influence on students' mathematical communication skills, with a contribution of 27.4%. This means that social media use is one of the factors that can support the development of students' mathematical communication, although other factors also contribute to these skills.

The interactive and participatory nature of digital learning environments can explain the positive influence of social media. Through social media, students are not only passive recipients of information but also active participants in learning activities. They can ask

questions, respond to peers' ideas, share solutions, and receive feedback from both teachers and classmates. These interactions encourage students to clarify their reasoning and organize their mathematical ideas more systematically. This is important because mathematical communication requires students to express ideas clearly, justify solution steps, and connect mathematical concepts with appropriate symbols, tables, graphs, or visual representations.

Social media also supports mathematical communication through its multimodal features. Images, videos, comments, voice notes, and shared documents allow students to present mathematical ideas in different forms [20], [21], [22], [23]. For example, students can explain a solution through written comments, upload images of their work, or use short videos to describe the steps in solving a problem. These features may help students who have difficulty communicating mathematical ideas only through conventional written formats. Therefore, social media can create a more flexible learning space where students can develop verbal, symbolic, and visual mathematical communication.

The findings of this study are consistent with previous research showing that social media can increase student interaction, engagement, and participation in learning. Alabdulkareem [24] and Junco [18] found that social media supports students' learning engagement through interactive communication and collaborative activities. However, the present study extends previous findings by showing that social media is not only related to engagement or motivation, but also to students' mathematical communication skills. This indicates that social media can be used not merely as an informal communication tool, but as a structured learning medium that supports mathematical discussion, reasoning, and representation.

The results also support the view that mathematical communication develops through interaction and discussion. When students exchange ideas and receive feedback, they have opportunities to revise their explanations, correct errors, and improve the clarity of their mathematical reasoning. In this context, social media provides an additional learning space beyond the classroom, allowing students to continue mathematical discussions without being limited by classroom time. This condition may help students become more confident in expressing mathematical ideas and more accustomed to communicating their reasoning.

From a practical perspective, the findings imply that teachers can integrate social media into mathematics learning in a structured and purposeful way. Teachers may use social media to facilitate group discussions, distribute learning materials, provide feedback, and encourage students to present mathematical solutions using various representations. However, the use of social media should be guided by clear learning objectives and classroom rules so that students remain focused on academic activities. Without proper guidance, social media may become a source of distraction rather than a learning support tool.

Despite its positive findings, this study has several limitations. First, the study was conducted in only one school with a relatively small sample size, so the findings should be generalized with caution. Second, the study did not control for other variables that may influence students' mathematical communication skills, such as prior mathematical ability, learning motivation, digital literacy, teacher feedback, and the quality of classroom interaction. Third, the study did not compare the effectiveness of different social media

platforms, so it remains unclear which platform is most effective in supporting mathematical communication.

Future research is recommended to involve a larger and more diverse sample, include pre-test and post-test data, and examine other variables that may mediate or moderate the relationship between social media use and mathematical communication skills. Further studies may also compare different social media platforms, such as WhatsApp, YouTube, Instagram, and TikTok, to identify which features are most effective for supporting students' mathematical reasoning, explanation, and representation.

4. CONCLUSION

This study examined the effect of social media use on students' mathematical communication skills in mathematics learning. The findings indicate that students who participated in social media-assisted mathematics learning obtained higher mathematical communication scores than those who received conventional instruction. Social media use was also found to have a positive and significant effect on students' mathematical communication skills.

The regression analysis showed that social media use contributed 27.4% to the variance in students' mathematical communication skills, while the remaining 72.6% was influenced by other factors not examined in this study. These findings suggest that social media can support mathematics learning by providing opportunities for students to discuss mathematical ideas, explain problem-solving procedures, receive feedback, and represent concepts through various forms of communication.

Based on these findings, teachers are encouraged to integrate social media into mathematics learning in a structured and purposeful way. Social media should not only be used as an informal communication tool, but also as a learning medium that supports interaction, collaboration, and mathematical explanation. Future research is recommended to involve larger and more diverse samples, include pre-test and post-test data, and examine the effectiveness of different social media platforms in developing students' mathematical communication skills.

REFERENCE

[1] C. Greenhow and C. Lewin, "Social media and education: reconceptualizing the boundaries of formal and informal learning," *Learn. Media Technol.*, vol. 41, no. 1, pp. 6–30, Jan. 2016, doi: 10.1080/17439884.2015.1064954.

[2] A. Barana, M. M. Conte, and S. Omegna, "Relationship between Mathematical Problem-Solving Skills and Asynchronous Collaboration in Digital Learning Environments.," *... for Development of the Information Society*, 2024, [Online]. Available: https://eric.ed.gov/?id=ED665508

[3] Y. Zheng *et al.*, "Effects of digital game-based learning on students' digital etiquette literacy, learning motivations, and engagement," 2024, *cell.com*. [Online]. Available: https://www.cell.com/heliyon/fulltext/S2405-8440(23)10698-0

[4] N. Yuliza, H. Herpratiwi, R. Firdaus, and ..., "Development of a Digital Learning Platform to Improve Math Problem Solving Skills," 2025, *scholar.archive.org*. [Online]. Available: https://scholar.archive.org/work/dswr7bml3bgudp7ir7pmazty7q/access/wayback/https://e-journal.undikma.ac.id/index.php/jtp/article/download/15157/7129

[5] H. G. Weigand, J. Trgalova, and M. Tabach, "Mathematics teaching, learning, and assessment in the digital age," 2024, *Springer*. doi: 10.1007/s11858-024-01612-9.

[6] Y. Zou, F. Kuek, W. Feng, and X. Cheng, "Digital learning in the 21st century: trends, challenges, and innovations in technology integration," 2025, *frontiersin.org*. doi: 10.3389/feduc.2025.1562391.

[7] NCTM, "Principles and Standards for School Mathematics," 2000. Accessed: Jan. 11, 2020. [Online]. Available: https://www.nctm.org/uploadedFiles/Standards_and_Positions/PSSM_ExecutiveSummary.pdf

[8] A. J. Baroody and R. T. Coslick., *Problem solving, reasoning, and communicating, K-8 : helping children think mathematically*. New York: Macmillan Publishing, 1993.

[9] J. Hiebert and D. Wearne, "Developing understanding through problem solving," in *Teaching mathematics through problem solving*, S. Charles, Ed., Reston, VA: NCTM, 2003, pp. 3–13.

[10] I. Aryani, J. Juariah, and T. K. Rachmawati, "Peningkatan Kemampuan Komunikasi Matematis melalui Game Based Learning Berbantuan Nearpod," *Numerical: Jurnal Matematika dan Pendidikan Matematika*, vol. 9, no. 2, pp. 268–278, Dec. 2025, doi: 10.25217/numerical.v9i2.6549.

[11] A. D. Prasetyo and D. Firmansyah, "Hubungan Media Sosial TikTok Terhadap Kemampuan Komunikasi Matematis Siswa," *Lattice Journal : Journal of Mathematics Education and Applied*, vol. 3, no. 2, p. 170, Dec. 2023, doi: 10.30983/lattice.v3i2.7596.

[12] L. T. D. Amelia and N. R. Balqis, "Changes in communication patterns in the digital age," *ARRUS Journal of Social Sciences ...*, 2023, [Online]. Available: https://jpabdimas.idjournal.eu/index.php/soshum/article/view/1992

[13] J. H. Lipschultz, *Social media communication: Concepts, practices, data, law and ethics*. taylorfrancis.com, 2023. doi: 10.4324/9781003281924.

[14] R. Nurdiansyah and T. H. Marcharis, "Efektivitas Penggunaan Media dan Model Pembelajaran untuk Meningkatkan Kemampuan Komunikasi Matematis," *Jurnal Analisa*, vol. 11, no. 2, pp. 169–179, Dec. 2025, doi: 10.15575/ja.v11i2.51699.

[15] L. D. Haeruman, Flavia Aurelia Hidajat, and Tri Murdiyanto, "Pengembangan Media Pembelajaran Matematika Berbasis Sosial Media Instagram dan software Geogebra pada Pokok Bahasan Dimensi Tiga," *Jurnal Riset Pembelajaran Matematika Sekolah*, vol. 7, no. 2, pp. 35–41, 2023, doi: 10.21009/jrpms.072.04.

[16] L. I. Mayowi and S. Maarif, "Analisis Kemampuan Komunikasi Matematis Pada Pembelajaran Matematika Berdasarkan Aspek Norma Sosiomatematik," *Wacana Akademika: Majalah Ilmiah Kependidikan Volume*, vol. 7, no. 1, pp. 1–17, 2023, doi: 10.38114/riemann.v2i2.101.

[17] S. Marlina, "Analisis Peran Media Sosial sebagai Platform Pembelajaran Kolaboratif di Era Digital," *Jurnal Media dan Teknologi Pembelajaran*, vol. 01, no. 1, pp. 1–9, 2025, [Online]. Available: https://ejournal.pustakabangsaindonesia.com/index.php/jmtp

[18] R. Junco, "Student class standing, Facebook use, and academic performance," *J. Appl. Dev. Psychol.*, vol. 36, pp. 18–29, Jan. 2015, doi: 10.1016/j.appdev.2014.11.001.

[19] K. Aesaert, D. Van Nijlen, R. Vanderlinde, J. Tondeur, I. Devlieger, and J. van Braak, "The contribution of pupil, classroom and school level characteristics to primary school pupils' ICT competences: A performance-based approach," *Comput. Educ.*, vol. 87, pp. 55–69, Sep. 2015, doi: 10.1016/j.compedu.2015.03.014.

[20] J. Engelbrecht and M. C. Borba, "Recent developments in using digital technology in mathematics education," 2024, *Springer*. doi: 10.1007/s11858-023-01530-2.

[21] K. Bansal, T. Mathur, T. Mathur, S. Agarwal, and ..., "Impact of social media on academics: a fractional order mathematical model," *International Journal of ...*, 2025, doi: 10.1080/02286203.2023.2286419.

[22] O. C. Ebere and S. M. Abaver, "Social Media Packages as Correlates of Academic Performance in Mathematics Among Students in Rivers State, Nigeria," *... Applied Sciences Journal of Mathematical ...*, 2024, [Online]. Available: https://www.fnasjournals.com/index.php/FNAS-JMNS/article/view/540

[23] E. Heyd-Metzuyanim, A. J. Sharon, and ..., "Mathematical media literacy in the COVID-19 pandemic and its relation to school mathematics education," 2021, *Springer*. doi: 10.1007/s10649-021-10075-8.

[24] S. A. Alabdulkareem, "Exploring the Use and the Impacts of Social Media on Teaching and Learning Science in Saudi," *Procedia Soc. Behav. Sci.*, vol. 182, pp. 213–224, May 2015, doi: 10.1016/j.sbspro.2015.04.758.