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Javier E. Garay is a professor in the department of Mechanical and Aerospace Engineering and the Materials Science and Engineering Program at the Jacobs School of Engineering at University of California, San Diego (UCSD). He received his B.S. in Mechanical Engineering, his M.S. and Ph.D in Materials Science and Engineering all from the University of California, Davis. During his PhD studies, he also worked at the Lawrence Livermore National Laboratory where he studied material defects using positron annihilation spectroscopy. Prior to his position at UCSD, he was a professor at UC Riverside where he also served as Chair of the Materials Science & Engineering Program.

As the director of the Advanced Material Processing and Synthesis (AMPS) Lab at UCSD, Professor Garay focuses his research on materials property measurements, the integration of materials in devices with application in optical devices, magnetic devices, thermal energy storage/ management, and materials synthesis and processing with an emphasis on designing the micro/nanostructure of bulk materials/thin films for property optimization. He is also particularly interested in understanding the role of the length scale of nano-/ micro-structural features on light, heat and magnetism.

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A.T. Charlie Johnson is a professor of physics in the Department of Physics and Astronomy at the University of Pennsylvania. He received his B.S. in physics from Stanford University and his Ph.D. in physics from Harvard University. He did postdoctoral fellowships at the Delft University of Technology (Applied Physics) and NIST (Cryoelectronic Metrology). His honors include the Christian R. and Mary F. Lindback Foundation Award for distinguished teaching at Penn, the Jack Raper Outstanding Technology Directions Paper Award of the International Solid State Circuit Conference, an Alfred P. Sloan Research Fellowship, and a Packard Fellowship for Science and Engineering.

Dr. Johnson's research is focused on the nano-scale transport properties (charge, energy, spin, etc.) of nanostructures and single molecules, including carbon nanotubes, graphene, DNA, synthetic proteins, and other biomolecules. He is particularly interested in the physical properties of hybrid nanostructures and their use in molecular sensing. Other research interests include the development of scanning probe techniques for electronic property measurement of nanomaterials and nanodevices, molecular electronics and nanogaps, local probes of nanoscale systems, and nanotube and nanowire electronics.

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Ben Slater is a professor at UCL Chemistry. He received his BSc in chemistry from the University of Nottingham and was awarded his PhD at the University of Reading. He did postdoctoral work at the Royal Institution of Great Britain (Ri) and became an assistant director of the Davy Faraday Research Laboratory at

the Ri in 1999. He joined UCL Chemistry in 2007 and was awarded the Royal Society of Chemistry Barrer prize in 2008.

Dr. Slater's research is focused on using atomistic computer simulation to understand and predict the structure and properties of materials. He has published extensively in the area of porous materials (including zeolites and metal-organic frameworks) and water ices. He has a particular interest in defects in materials and surface mediated processes, such as crystal growth.

Masaaki Tanaka
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Masaaki Tanaka is a professor at the Department of Electrical Engineering & Information Systems Graduate School of Engineering, University of Tokyo. He received his Ph.D. in electronic engineering from the University of Tokyo in 1989. In 1992, he joined Bell Communications Research (Bellcore) at Red Bank, New Jersey, as a visiting research scientist. Since 1994, he has been at the University of Tokyo as an associate professor and professor.

Dr. Tanaka's main research field is spin electronics ("spintronics"), in which the spin degrees of freedom are used in artificially synthesized materials. Among the areas of his specific research are epitaxial growth, structural characterizations, electronic/optical/magnetic/spin-related properties (in particular, spin-dependent transport and mageto-optical properties), and device applications of various new structures. His research on structures and devices includes ferromagnetic metal / semiconductor hybrid structures, III-V-based magnetic semiconductors and their heterostructures, group-IV-based magnetic semiconductors, ferromagnetic nanoparticles and semiconductor hybrid heterostructures, delta doping of magnetic impurities in semiconductor heterostructures, and new spin transistors (e.g., spin-MOSFET) and reconfigurable logic devices.

Enge G. Wang
Peking University,
Beijing, P. R. China

Enge Wang is a professor of physics and President Emeritus of Peking University. He also chairs the Advisor Board of the Institute of Physics, Chinese Academy of Sciences (CAS).

Dr. Wang's research focuses on surface physics; the approach is a combination of atomistic simulation of nonequilibrium growth, chemical vapor deposition of light-element nanomaterials, and water behaviors in confinement system. He and his coworkers also predicted a three-dimensional Ehrlich-Schwoebel barrier, which attracted News and Views in Nature (June 2002). Another contribution is the model proposal and experimental validation of a true upward atomic diffusion. This was reported in Physics News Update in June 2003 and News and Views in Nature as well as Science Week in June 2004.

His work on water-surface coupling and the strength of hydrogen bonds at the interfaces provides a fundamental understanding of water on surface at the molecular level.

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Preface: The 5th International Conference on Mathematics and Science Education (ICoMSE) 2021

ICoMSE has been held annually by the Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang, Indonesia, since 2017. The conference has proven to be worth considering since its first event was evinced by the high number of participants from several countries, successful, engaging event, and numerous articles published in its proceedings after two-step blind review.

This year, the 5th ICoMSE's theme of "Science and Mathematics Education Research: Current Challenges and Opportunities" was held virtually due to the high spreading of COVID-19. Nonetheless, the enthusiasm of the researchers and academicians to contribute never recedes. 287 talks in six fields (Biology Education, Chemistry Education, Mathematics Education, Physics Education, Science Education & educational technology, and Science) have been delivered in this conference creating interesting discussion which accommodated them to share their experiences, offer their insights, point the challenges up, and suggest new solutions in the fields. Amongst those hundreds of abstracts submitted to the committee, 151 qualified papers were accepted to publish in this proceeding. We do hope that the ideas shared in this proceeding will stimulate the dissemination of valuable knowledge in the relevant area.

For this success, please allow me to thank all the participants for putting their best ideas into this conference and the committees for their hard work. In particular, I would like to express my highest appreciation and gratitude to the keynote speakers:

- Professor Vicente A Talanquer, Ph.D from University of Arizona, USA
- Professor Dr. Mustafa Sozbilir from Atatürk University, Turkey
- Professor Dr. Zaidatun binti Tasir from Universiti Teknologi Malaysia, Malaysia
- Dr. Marianne Achiam, M.Sc. from University of Copenhagen, Denmark
- Dr. Sentot Kusairi, S.Pd., M.Si. from Universitas Negeri Malang, Indonesia
- Dr. I Gusti Darmawan, M.Sc. from Adelaide University, Australia.

I believe that this conference will catalyze sharing experiences and knowledge in mathematics and science education and build networking between academicians, practitioners, and researchers. This conference has been a chance to promote and share our research results and valuable ideas so everyone who shares common interests can discuss and even adopt them.

Malang, December 2021

Habiddin, Ph.D
Chairman

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Niluh Sulistyani, Cyrenia Novella Krisnamurti, Leonardo Amaris Liaupati, et al.

The Use of Instagram to Facilitate Middle School Mathematical Literacy

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Abstract. This research is motivated by the low mathematical literacy skill of Indonesian students and the existence of Instagram as one of the online learning media during the pandemic. The purpose of this research is to describe the use of Instagram to facilitate mathematical literacy for 85 grade VIII students at a private junior high school in Jakarta and to find out the subjects' responses to the use of Instagram. Data were gathered by Instagram media analysis and questionnaire distribution. Data were analyzed by descriptive and qualitative methods. The results of this study showed that Instagram was used as a medium for evaluating mathematical literacy. Instagram was used limitedly to display mathematical literacy problems with the scope of mathematics material for middle school grade VIII. Researchers used Instagram feeds to introduce the context of the literacy problems to students, show the question, and display the discussion and solution. The questionnaire responses showed that the subjects agreed to the use of illustrations in Instagram because it helps in understanding the questions and adds to the attractiveness. The subjects suggested simplifying the solutions and the using of video to explain the solutions would be more effective and easier to understand. Because of the limited use of Instagram, the influence of Instagram on literacy skills has not been explored further.

INTRODUCTION

The Covid-19 pandemic has caused the Indonesian government to adopt a policy of holding online learning from home since March 2020 (1). Educators as facilitators in learning need to adjust these policies. The most fundamental change in online learning is in terms of the use of technology. Likewise with learning mathematics. Mathematics learning needs to be supported by various technologies, both synchronous and asynchronous.

One of the roles of technology in online learning is as a learning media. The use of various methods and media greatly determines the success of learning mathematics (2). However, educators need to choose the right media so that learning can be carried out properly.

The selection of media needs to pay attention to many things, one of which is that the media is easy to use by students. Regarding online media, teenagers in Indonesia mostly use the internet as a means of social media. By 2021, it is predicted that the use of social media will increase by more than 3 million users. A survey in 2019 showed that the 5 most used types of social media by users are Facebook, Instagram, Twitter, Tumblr, and LinkedIn (3).

One of the social media that is familiar among students is IG. Instagram is one of the social media that is actively used in Indonesia. Of Indonesia's total population of 265.4 million in 2018, 130 million (49%) actively use social media. Meanwhile, monthly active use of Instagram social media in Indonesia reaches 53 million people (4). Instagram is one of the most widely used social media by teenagers today. Thus, junior high school students who are teenagers are very familiar with Instagram social media.

IG has been widely used in learning. IG can be used in ESL classrooms because it is an effective tool for interacting, especially conducting discussions (5). Instagram is more effective in retrieving information than Twitter (6). Instagram media can be used at all levels of education and all subjects (7). GI is the most widely used in learning at the elementary level (56.7%) followed by the junior high school level (31.2%). Based on the subject of learning, GI

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is widely used in learning Language (69.3%), Social (54.3%), Mathematics (53.9%), Science (49%), and other subjects. The results also show that the majority of educators recommend using Instagram as a medium in learning, one of the reasons is because Instagram is the most frequently accessed by users compared to other social media.

Instagram has also been widely used in learning mathematics. The use of Instagram in learning mathematics can increase motivation (8). In addition, many studies use IG as an effective learning medium on certain topics, such as Construct Space (9), Circle (10), Function Graph (11), and Derivatives (12).

Learning mathematics online in addition to using the right media also needs to pay attention to its essence. One of the things that need to be trained is mathematical literacy skills. Mathematical literacy is a fundamental skill that is indispensable as well as language and therefore, mathematical literacy should be one of the main goals in learning (13); (14).

Mathematical literacy is not limited to the ability to apply quantitative aspects of mathematics but involved mathematical knowledge in a broad and comprehensive sense from several parts, namely spatial literacy, numeracy, and quantitative (15) . The main purpose of literacy is to see the world through mathematics, so that literacy place mathematics as a high-level thinking activity encompassing problem-solving abilities (16).

Mathematical literacy which contains HOTS is important but has not been fully mastered by students. One of the pieces of evidence is shown by the results of PISA (Program for International Student Assessment) which provides HOTS-based questions to measure the literacy ability of 15-year-old students. The literacy ability and HOTS of Indonesian students are still low. The latest PISA results in 2018 showed that Indonesia was in 71st place out of 78 countries (17). The same results were also shown in the previous 2 periods, namely in 2012 and 2015 where the ability of Indonesian students was at the bottom, namely in the order of 64 out of 65 countries in 2012 and 63 out of 70 countries in 2015 (18) (19).

Improved literacy can be applied in the learning process by applying several strategies. These strategies include using vocabulary and notation, schema, making connections, making predictions and conclusions, and making visuals. To support the 4.0 era, the implementation of strategies to improve mathematical literacy needs to be supported by the use of appropriate technology. Digital technology can be applied in learning to understand mathematics and literacy. Children's activities with digital technology appear to activate, expand and transform their understanding and use of literacy and mathematics (20).

Instagram social media has an interesting image display feature. Instagram users can easily upload images and do editing from the available features. When it comes to mathematical literacy, the features in Instagram support the visualization strategy. The attractiveness of Instagram is expected to encourage users, including junior high school students, to further understand the content contained in it, including those containing mathematical literacy. Therefore, the purpose of this study was to describe the use of Instagram media in facilitating junior high school mathematical literacy skills and to determine student responses to the use of the media.

METHOD

This study is a descriptive study with the subject of 85 students of class VIII at a high school in Jakarta. The data in the study were collected by document analysis, namely Instagram media analysis and questionnaire distribution. In the procedure of this research, the researchers designed IG media with mathematical literacy content. The research subjects then used IG media in learning mathematics, then at the end of the lesson students were asked to fill out a questionnaire with the help of a google form. The data obtained were then analyzed qualitatively. The data obtained from open-ended question were analyzed with open coding.

RESULT AND DISCUSSION

The Use of Instagram to Facilitate Literacy Skills

At the beginning of the study, researchers planned to use various features on IG from feeds, DMs, to stories and combine various kinds of content such as materials delivery and evaluations (quizzes and questions) based on mathematical literacy. However, due to time constraints at school, the use of IG was only limited to display mathematical literacy problems with the scope of mathematics material for middle school grade VIII.

In literacy problems, there is a context that is a place for students to use mathematics. Students have not always experienced the same context as the problem, but they are still familiar and can understand the context. Therefore, the context of the problem needs to be introduced to students before students see the problems that they need to solve.

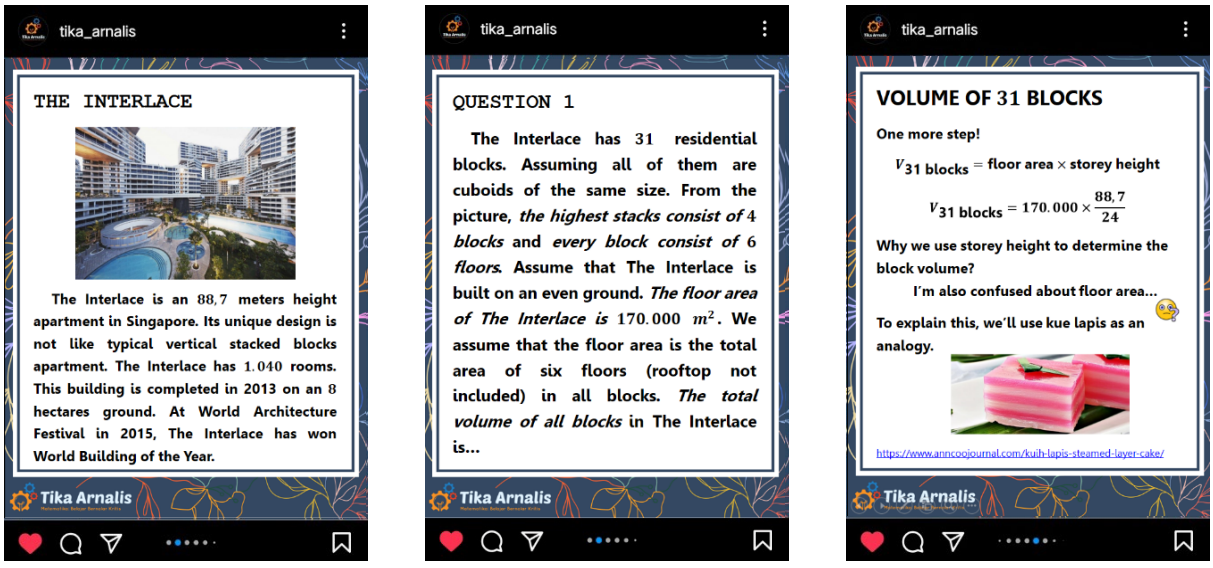
Researchers used Instagram feeds to introduce the context of the problems to students. The context displayed is in the form of texts and illustrations that contain information needed by students to formulate solutions or answers to the questions asked, but not all information is used to solve problems. The context of the problem also contains a promotion that the context is important to discuss because it is closely related to areas of human life such as environment, architecture, health, and art.

Researchers made three problems and each problem has its context. Therefore, the researcher used three feeds and each feed contained the context of one problem. The number of pages per feed varies depending on the amount of text and illustrations in the context. The first page of each feed contains the title of the problem and its illustration. On the following pages, there are subtitles at the top left. A subtitle is a phrase that contains the main idea of the page. Researchers made subtitles because the small Instagram feed page cannot accommodate the whole text and illustrations. Therefore, the researcher divided the text and illustrations into several pages and ensured that closely related sentences were on the same page. Researchers uploaded these three feeds on the day before students work on the problems. Students read the questions and answered the questions on the LMS. The discussion and solution of the problems were displayed in the feed a week after that.

Each problem is discussed in three feeds because each problem contains more than one question. For The Interlace problem, each feed contains one question and its discussion. As for the Covid-19 Health Protocol and Pyramid du Louvre problems, the first feed contains all questions, and the remaining two feeds contain discussion. Just like context feeds, the first page of each feed contains its title and illustration. The division of lengthy discussion steps into several pages also requires that closely related steps are not page-separated.

In the discussion feeds, subtitles not always contain the main idea. Some subtitles are an instruction or message to students, for example, "Let's reason," and "So this is the story." The discussion is written in the semi-formal, communicative language, and is supported by illustrations to represent calculations and geometric explanations. Communicative language does not only exist in the explanation of solutions, but also in introductory sentences and transitions between parts of the solution, such as, "They said this was the most difficult problem!!!," and "We can use the Pythagorean theorem again but from a different angle." Another variation of the sentence is an interrogative sentence. There are question sentences to encourage students to think before seeing the solution, for example, "What about the red seat?". There are also interrogative sentences that are assumed to come from students to question the discussion that has been presented, for example, "Is it true that the height of each floor is the same? There was no information given about it, right?"

An example of using an Instagram feed as a viewer of context, questions, and discussions is shown in Figure 1.



Context Questions Discussions

FIGURE 1. Example of Feeds (Source: Instagram.com/tika_arnalis)

There are four characteristics of discussion feeds in terms of visual design. The first is coloring some parts of the text. The text is colored when there is more than one important object discussed in a part of the solution. The same color is applied to the object and the calculations or strategies associated with that object. The aim is to contrast the differences between objects and the calculations or strategies associated with them. If there is only one object that is the focus of discussion in a part of the solution, it is enough to write that object in bold. The second characteristic is the avatar. The avatar is shown several times as someone communicating to the student. Therefore, researchers put the dialog near the avatar image. The third characteristic is the reminder. On the second page of some feeds, researchers reminded students to first look at the corresponding context and questions feeds so that students do not lose context when understanding the discussion. In this section, the researcher displays the front page of those feeds. Fourth, if the researcher cited the question in the discussion content, the researcher made a frame to distinguish it from the solution explanation.

The choice of using feeds as a medium to display questions and discussions takes into account the suitability of the type of content presented in the feed. The feed feature in IG is useful for posting images and videos along with an explanation in the caption section. This is in accordance with research conducted by (21) that feeds are often used to collect assignments in the form of photos or videos. From these posts, students or users can add a caption or description that explains the photos.

Students' Responses to IG media

Data on students' responses to the use of IG in this study were obtained from the results of the questionnaire. The indicators on the questionnaire are shown in Table 1.

TABLE 1. Questionnaire Indicator

Code	Indicators
X1	Discussions and questions on IG are easy to access
X2	The discussion feature in IG is easy to operate
X3	The flow of discussion can be understood clearly
X4	The illustrations shown help understand the explanation
X5	Interesting discussion view
X6	Illustrations shown to be interesting
X7	The language used is easy to understand
X8	Illustrations like the picture shown are easy to understand

The above indicators are used as a guide for compiling a questionnaire distributed to respondents. The questionnaire was responded to by 85 students. The results of the questionnaire can be seen in Table 2 below.

TABLE 2. Results of the Descriptive Analysis of the Questionnaire

Indicators	X1	X2	X3	X4	X5	X6	X7	X8
Mean	3.07	2.99	2.93	3.09	3.08	3.01	3.06	3.02

TABLE 3. Codes constructed from the data about students' responses to literacy problems

Code	Frequency
Simplify the problem	28
Clarify the problem	14
Extend the test time	26
Diversity of difficulty levels	2
Equivalent to learning level	4
Shorten the problem	2
More contextual	2
Used as a project	1
Multiple choice	1
Organize the series of questions	1
Illustration	1
Don't use LCMS	1
Handwritten answer	1

Based on the results of the questionnaire responses, the indicator that has the highest average is X4. In this case, the respondents agreed that illustrations could help them understand the explanation. Besides helping to understand the questions, illustrations were also considered interesting to watch. Respondents agreed that the appearance of the discussion of the problems was interesting to watch. This can be a special attraction for readers.

The questions and discussion feed on Instagram were considered easy to access. In addition, the features on Instagram that were used in discussing problems are easy to operate. One of these features is slides of feeds. Although Instagram feed can only contain 10 slides, it can be designed so that the flow of the discussion can be covered entirely. Respondents also agreed that the flow of discussion could be clearly understood. Even though the discussion on Instagram uses a semi-formal language, respondent agreed that the language used in the discussion is easy to understand.

Table 3 shows codes constructed from the data about students' responses to literacy problems. The codes that often appear are simplify the problem, clarify the problem, and extend the test time. The respondents complained about the complicated questions. Some respondents wrote, "Don't make the problem too complicated." Codes related to simplify the problem are diversity of difficulty levels and equivalent to learning level. Respondents stated that there were difficult questions, but there were also easy ones. Equivalent to learning level code means respondents compared literacy problems with the materials that they learned in class. Some respondents thought, "The problems that were given should not be too far from practice so (I) know where to learn from," and "Don't give problems that have never been taught because if there are problems that have never been taught, I'm afraid I can not to solve it."

Clarify the question code indicates that respondents complained about the language in the problems that were difficult to understand. One respondent explained specifically, "(The) Interlace problem was very confusing and required assumptions, so students' answers could vary." Many respondents agreed that the test time was insufficient so that two solution options emerged: extending the test time or adjusting the questions with time, both in terms of quantity and level of difficulty. Shorten the problem code related to extend the test time and simplify the problem code. One respondent thought that the problems did not need to use context articles, which was a waste of time. Another respondent juxtaposed the words "long" and "complicated" in their criticism of literacy problems. The researcher also coded the respondent's answers which mentioned specific problems. One respondent wrote, "The difficulty level of the problems is very high, especially for The Interlace problem, I need to try on paper many times to succeed." More complete student responses can be seen in table 4 below.

TABLE 4. Response to the specific problem

	The Interlace (design)*	**The Interlace**	**Covid-19**	**Pyramid**
Simplify the problem	2	5	1	2
Clarify the problem	0	3	1	2
Extend the test time	2	2	0	0

* Some respondents specifically mention the part of The Interlace problem. The frequency of this code is not included in the frequency of The Interlace code.

Two respondents discussed contextual problems. The first respondent stated, "My suggestion is for the next final exam, please present problems that are equal to students' abilities and applicable in everyday life." The second respondent suggested that the problems be given in the form of a project, "Through this project, my friends and I could solve real-world problems that are happening, not just literacy problems. Just like the math problems in collaboration with PPKN which discussed waste problem and endangered animal." This collaboration project was once given by the teacher in the learning process. Both of these respondents agreed that contextual problems made them understand the benefits and importance of mathematics in life.

Other suggestions from respondents were researchers also gave multiple-choice questions, organize the series of questions, improved the quality of the illustration images, did not use learning management system in displaying questions, and provided questions that prompted handwritten answers.

Table 5 shows codes constructed from the data about students' responses to the discussion of the problems. It can be seen that the video, clarify the discussion, and rambling code often appeared in the responses. The respondents felt that the discussion of the problems presented was still rambling. Some respondents said, "Using the simplest things to explain without rambling". This made respondents feel that the discussion is not clear, so it needs to be clarified again. Respondents suggested that in the discussion of problems on Instagram, videos should be included to make it easier to capture the ideas of the discussion. Some respondents found it difficult to find a flow of ideas of the solution. Respondents feel confused describing the desired conditions. In addition, some respondents suggested using google

docs to better understand the discussion, because the feeds on Instagram are quite limited and google docs can reduce the density in one feed.

TABLE 5. Codes constructed from the data about students' responses to the discussion of the problems

Code	Frequency
Used Slide	2
Solid writing	2
Separation of discussion	2
Font	2
Video	6
Language	3
Calculation	3
Clarify the discussion	5
Rambling	5
Google docs	1
Bolding	1
Chat Q&A	1
Don't have an account	1
Illustration	2
More problems	1
Difficult problem	1
Colour variations	1

The language code showed that the respondents still felt unfamiliar with the language used in the discussion. This was shown from the respondent's expression who wrote "The language is too complicated to understand". The separation of discussion code means that before uploading the discussion, it is better to upload the problem first. Not infrequently respondents also found calculation errors from the discussion that have been presented.

Design, fonts, illustrations, and colors were the focus of the respondents. Respondents suggested using a font that is easy to read. The illustrations in the discussion are also considered quite good but need to be developed so that they are more interesting and not boring. Another suggestion from respondents was varying the colors to attract attention and readers feel not bored.

The calculation code means that there are still some calculations in the discussion that is still inaccurate. This could be caused by human error. The meaning of the bolding code is that important things in the discussion should be bolded so that they are easy to be reviewed. Chat Q&A code means there were respondents who suggest that there is a question-and-answer interaction through the comment's column or direct message feature. The don't have an account code means that there were respondents who do not have an Instagram account, so they found it difficult to access the discussion. While the more problems code is shown to the Instagram account @tika_arnalis to add questions and discussions so that it can be a learning media. Likewise, the difficult problem code means that the problems in the @tika_arnalis account are considered to be still too difficult.

CONCLUSION

Instagram was used as a medium for evaluating mathematical literacy. In this research, Instagram was used limitedly to display mathematical literacy problems with the scope of mathematics material for middle school grade VIII. Researchers used Instagram feeds to introduce the context of the problems to students, show the question, and display the discussion and solution. The context displayed was in the form of texts and illustrations that contained information needed by students to formulate solutions or answers to the questions asked, but not at all information was used to solve problems. After the context, the Instagram feed displays the questions of literacy problems. The problem solutions were displayed in the feed a week after the student did the test. The results of questionnaire responses showed that (1) the subjects agreed to the use of illustrations in Instagram because it helps in understanding the questions and adds to the attractiveness. (2) The subjects suggested that the use of video to explain the solutions would be more effective and easier to understand according to the results of the questionnaire with an average of 3,09. (3) The subjects also suggested simplifying the solutions according to an open analysis result of the respondents. Because of the limited use of Instagram, the influence of Instagram on literacy skills has not been explored further.

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