Indonesian Journal of Mathematics Education
Vol. 5, No. 1, April 2022, pp: 26~32
p-ISSN: 2654-3907, e-ISSN: 2654-346X, DOI: 10.31002/ijome.v5i1.5561
e-mail: ijome@untidar.ac.id, website: jurnal.untidar.ac.id/index.php/ijome

Teachers' and Students' Perceptions of Android-based Mathematics Learning Media Development by Integrating GeoGebra

Ayu Mastura[a)], M Ikhsan[b)], Mailizar
Magister Pendidikan Matematika, FKIP, Universitas Syiah Kuala, Jl. Teuku Nyak Arief, Kopelma Darussalam, Kota Banda Aceh, Indonesia.
e-mail: [a)]ayumastura23@email.com, [b)]ikhsan@unsyiah.ac.id

Abstract

The utilization of technology as a learning resource or media has been widely used as an innovation to promote learning. It is expected to stimulate the thoughts, feelings, interests, and attention of students in learning. The purpose of this study is to find out teachers' and students' perceptions of the need for Android-based mathematics learning media on geometry transformation. This research used a descriptive qualitative approach. Data was collected using validated questionnaires for teachers and students. The subjects of this study were mathematics teachers and 2nd-grade students at a senior high school in Aceh, Indonesia. The data was analyzed using descriptive statistical methods. The results showed that the geometry transformation subject was difficult for students. The various formulas and the material's abstractness make understanding the transformation subject challenging. Less attractive learning sources or media and a lack of variety in learning approaches are also influential factors. This study also revealed that teachers were still not optimal in utilizing the various available technological media. Thus, teachers and students need interesting and innovative learning media that can assist students in exploring abstract mathematical concepts, especially geometry transformation. These results became an important reference in the development of Android-based learning media assisted by GeoGebra Software.

Keywords: android, GeoGebra applet mathematics learning media

INTRODUCTION

Rapid technological advancement has brought numerous effects on changes in classroom learning practices. Schools are challenged to design instruction that can assist students in developing the abilities required in the twenty-first century, particularly in mathematics (Voogt & Roblin, 2012; Nahdi, 2019). Thus, mathematics learning must be designed in such a way to help students develop these skills. Teachers should be able to utilize various learning media and develop their skills in making various innovative learning media that support the learning process. Learning media applied in schools is expected to motivate students to be more active in learning activities.

Learning media can be defined as a tool or object that is an intermediary to convey messages or information from the sender (teacher) to the recipient (student) to support the learning process (Novaliendry et al., 2020; Susilana & Riyana, 2009; Zainiyati, 2017). Various kinds of learning media are available and can be used in the learning process in the classroom such as audio media, visual media, audiovisual media, etc. In addition, various learning media are also available with unlimited use of technology, including computer technology, laptops, the internet, and even smartphones which can be used as sources and effective learning media (Clark-Wilson, Robutti & Thomas, 2020).

The use of Information Technology (IT)-assisted learning media has been widely applied to facilitate the implementation of learning. One of the technology media that is widely used today is an Android-based Smartphone. Android is an open-source mobile operating system developed by Google Corporation which is the largest search engine in the world (Rogers, Lombardo, Mednieks &

Meike, 2009). Android has become a very popular operating system because of its effectiveness and efficiency. Android is also popularly used for educational purposes because of its convenience and flexibility. The learning that adopts the system and mobile devices in the form of Android is known as mobile learning. According to Bidin and Ziden (2013), mobile learning has been widely used because it is accepted as an effective technique for gaining knowledge, it can be accessed anytime and anywhere so it can be utilized in many ways in the education industry. Several empirical studies have also demonstrated that mobile devices can support pedagogical approaches or strategies (Bidin & Ziden, 2013), including (a) collaborative learning, where the accessibility of mobile devices supports inclusion and allows for more opportunities to participate; (b) blended learning, where students can carry out their assignments and projects using mobile devices after class sessions with their instructors; and (c) interactive learning, where mobile devices can function as interactive agents, enables different levels of interactivity and engagement with technology; (d) problem-based learning, where students can actively find and work with content that is deemed necessary to solve problems given by the teacher by using mobile devices (PDAs or Smartphones).

Learning media built on Android is considered to be able to stay up with the times. According to Calimag et al. (2014), the use of an Android-based learning media is one of the applications of 21st-century learning styles (Yektyastuti & Ikhsan, 2016). Several previous studies have developed Android-based learning media with various versions, one of which is the development of Android-based mathematics learning media called JiMath for high school students (Hendriawan & Septian, 2019). The mathematics learning media developed in this study is in the form of an Android application with .apk format that can be installed on Smartphones and downloaded from Google Play using the search term JiMath. Agustin and Ambarawati (2019) have developed an Android-based Mathematical Encyclopedia that can be used on a computer or laptop with a Windows operating system. Other research, meanwhile, showed that the use of Android-based learning media has the potential to improve students' academic performance in the form of learning motivation and learning outcomes, both in the classroom or as an independent learning media (Dwiranata, Pramita & Syaharuddin, 2019; Hendriawan & Septian, 2019; Ahmar & Rahman, 2017; Yektyastuti & Ikhsan, 2016; Lubis & Ikhsan, 2015). Astra, Nasbey, and Nugraha (2015) stated that technological advancements in learning have enabled breakthroughs in which many students have utilized mobile devices and the internet to conduct mobile learning (m-learning) where they may access learning materials anytime and anywhere. This result confirmed that Android-based mobile learning offers an opportunity for anyone to access learning in an easy and fun way. This advantage implies that an attractive Android-based learning media with various visual data that refers to dynamic displays is needed.

Based on the explanation above, it is necessary to conduct further research to investigate how the learning media needed by teachers and students can support the mathematics learning process and observe whether the development of Android-based mathematics learning media is a necessity. The purpose of this study is to describe the analysis of the needs of Android-based learning media for geometry transformation subjects in high school mathematics learning.

METHOD

This research used a descriptive qualitative approach**.** The qualitative descriptive study aims to summarize the data comprehensively based on a certain condition or situation experienced by an individual or group (Lambert & Lambert, 2012; Mertler, 2016). The subjects in this study were

mathematics teachers and 2nd-grade students of a senior high school in Aceh, Indonesia, which consisted of four teachers and 73 students. The data collection process was performed by using questionnaires to analyze the needs of teachers and students, which had been validated by two experts. The questionnaire consists of eight questions for students and eight questions for teachers. The data was obtained in the form of student and teacher responses to the need for using learning media in learning mathematics.

Furthermore, the researcher used descriptive statistical methods to analyze the data. Sholikhah (2016) suggested that descriptive statistics are used to analyze data by describing the data that has been obtained without intending to make generally accepted conclusions or generalizations. Therefore, the data was then converted into the form of percentages, which is presented in the form of graphs to facilitate researchers in concluding.

RESULT AND DISCUSSION

The main data for the needs analysis was in the form of questionnaires that were distributed to 73 students and four mathematics teachers at the school. The findings of these questions are presented graphically to make the data easier to understand. Figure 1 shows the teacher's teaching style.

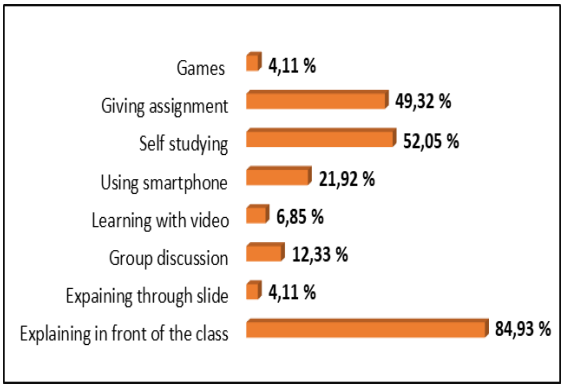

Figure 1. Teachers Teaching Style (Answers May be More Than 1)

According to Figure 1, the most dominant teaching technique used by teachers in classroom learning is the lecture method (explaining the learning material in front of the class), and the least utilized by teachers is learning through Powerpoint and games, with a percentage of 4.11%. The data above also shows that teachers often provide exercises or assignments and ask students to study independently. The graph below shows the many methods and learning styles that students frequently employ at home.

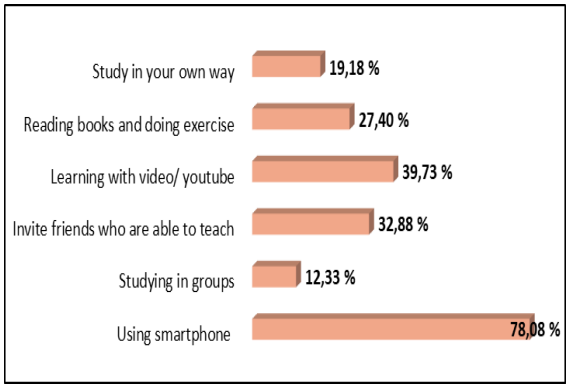

Figure 2. Students Learning Style at Home (Answers May be More Than 1)

Figure 2 shows that 78.08% of students answered that the learning style most often used during learning at home independently is learning through smartphones. Besides, the students often do the learning through videos or YouTube. The following graph presents the various technology-based media that have been used by mathematics teachers at the school in learning.

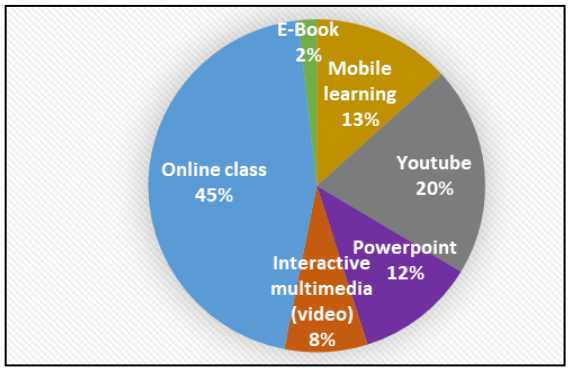

Figure 3. Utilization of Technology in Learning

Based on Figure 3, it can be seen that the technology media most often used by teachers in learning is through online class platforms, such *as Google Classroom,*

Whatsapp, and *Quipper*. The teacher mentioned that another technological media used to help students learn mathematics is YouTube, since it can be easily accessed and used by students.

Furthermore, data from the student questionnaire revealed that 52 students (71.2 percent) thought the transformation geometry topic was difficult to grasp. The mathematics instructor also indicated that students were still having problems grasping the content of geometric transformations and calculating point shadows and pictures. Graph 4 also shows statistics on the results of student replies relative to the complexity of the transformation subject. The amount of formulae in the content, as reported by 30 students (41.10%), and the fact that the information is excessively abstract (22 students = 30.14%), dominate student learning issues. However, 17 students (23.29%) stated that it was difficult to understand the transformation material because the sources or learning media used were less attractive and the way the teacher presented it was less varied (12 students = 16.44%).

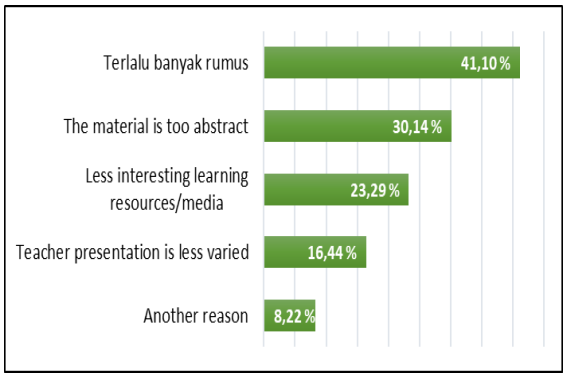

Figure 4. Students' Difficulty in Understanding Geometric Transformations (Answers May be More Than 1)

Mathematics teachers at the school have made efforts to overcome students' difficulties in understanding the transformation material. One of the efforts is increasing students' motivation and interest in learning by providing examples related to everyday life; providing image simulations of points, lines, and fields; and asking students to do exercises or tasks. However, data from the teachers' questionnaire indicated that lecturers' efforts in selecting learning methods and using learning media for learning geometry transformation have not been able to optimize students' understanding of the learning materials**.**

The results showed that the learning methods used by mathematics teachers were still less varied. The teachers more often use the lecture method and rarely use technology media to help students understand mathematical concepts. Teachers mostly use the blackboard as a learning media to deliver math material. This is one of the factors that causes students to not be able to understand mathematical concepts well, especially the topics that require high abstraction skills. In line with the results of research by Lutvaidah (2016), it shows that learning methods have a significant effect on mastery of mathematical concepts. According to Kozma (1991), the use of appropriate learning methods can affect the learning process, as well as the use of media in learning, can help students improve their cognitive skills. In short, learning methods and media play an important role in helping students understand mathematical concepts.

Furthermore, teachers frequently provide exercises or assignments and ask pupils to study independently. According to the study's findings, the majority of students use smartphones while studying at home on their own. This demonstrates that technology is a resource or media that is widely used in learning, both in the classroom and in independent learning. Clark-Wilson et al. (2020) mention that technology products in education today have reached millions of users around the world since technology can support the implementation of learning (Ejikeme & Okpala, 2017). However, the data from the questionnaire analysis showed that the use of technology in the school is still relatively low**.** Online classrooms in the form of Google Classroom, Whatsapp, and Quipper are the most frequently used technology media in learning by teachers; this is also one of the

effects of the ongoing COVID-19 epidemic, where learning must be done online.

The results of the data analysis show that the geometry transformation material is difficult. Several previous studies have also found that students still have difficulty understanding the material of geometric transformation (Handayani & Sulisworo, 2021; Rahmi, Armiati & Syarifuddin, 2021). The various formulas and content that are too abstract are the causes that cause students' challenges in grasping geometry transformations**.** Fuys, Geddes, and Tischler (1988); Tahta (in Wah, 2015) added that learning geometry is not an easy process since learning geometry is very abstract and difficult to understand. As a result, many students can not actively participate in learning. Students have difficulties understanding the notion of geometric transformation due to less attractive learning media and a less varied presentation style by the teacher**.** This finding explains that learning resources or media that can attract students' attention during learning and an attractive teacher's teaching style can make students more interested and motivated so they can develop their creativity and increase teaching effectiveness at the same time (Kozma, 1991; Novaliendry et al., 2020).

It is found that teachers and students have not been supported by learning media that can help students understand the transformation material well in the process of learning mathematics**.** Previously, GeoGebra software was used in various classes at the school to help students study mathematics. The results of the students' need analysis and the information expressed by the mathematics teachers became an important reference in the development of Android-based learning media assisted by GeoGebra Software. According to the mathematics teachers, Android-based learning media assisted by GeoGebra Software may help students understand geometry transformation material where students are expected to explore abstract mathematical concepts. Several studies have shown that using GeoGebra can make it easier for students to understand geometric concepts and help students develop creative thinking skills (Alkhateeb & Al-Duwairi, 2019; Jelatu, Sariyasa & Ardana, 2018; Wassie & Zergaw, 2019). Moreover, according to students at the school, the use of learning media is very important in supporting the learning process.

CONCLUSION

Based on the results of the research and discussion above, students still have difficulties understanding the geometry transformation subject. The numerous formulae and content that are too abstract are the causes of students' difficulty learning geometry transformations. Furthermore, less attractive learning resources or media and less diversified means of presentation are variables that contribute to students' inability to comprehend geometry transformation. The results of the study indicate that teachers are still not optimal in utilizing technology-based learning media during the mathematics learning process. Thus, teachers and students need learning media that can encourage students' creativity in the mathematics learning process.

According to the findings of this study, teachers and students require learning materials that can assist students in understanding abstract mathematical concepts. Interesting and creative learning materials are also required in order to improve students' interest and motivation during the learning process. In addition, the results of the students' need analysis, and the information expressed by the mathematics teachers has become an important reference in the development of Android-based learning media assisted by GeoGebra Software.

REFERENCES

Agustin, R. D., & Ambarawati, M. (2019). Mathematics encyclopedia media as android based learning. *International Journal of Scientific and Technology Research*, *8*(9), 1–4.

http://www.ijstr.org/research-paper-publishing.php?month=sep2019

Ahmar, A. S., & Rahman, A. (2017). Development of teaching material using an android. *Global Journal of Engineering Education*, *19*(1), 72–76. https://doi.org/10.26858/gjeev19i1y2017p7376

Alkhateeb, M. A., & Al-Duwairi, A. M. (2019). The effect of using mobile applications (GeoGebra and sketchpad) on the students' achievement. *International Electronic Journal of Mathematics Education*, *14*(3), 523–533. https://doi.org/10.29333/iejme/5754

Astra, I. M., Nasbey, H., & Nugraha, A. (2015). Development of an android application in the form of a simulation lab as learning media for senior high school students. *Eurasia Journal of Mathematics, Science and Technology Education*, *11*(5), 1081–1088. https://doi.org/10.12973/eurasia.2015.1376a

Bidin, S., & Ziden, A. A. (2013). Adoption and application of mobile learning in the education industry. *Procedia - Social and Behavioral Sciences*, *90*, 720–729. https://doi.org/10.1016/j.sbspro.2013.07.145

Calimag, J. a N. N. V, Miguel, P. A. G., Conde, R. S., & Aquino, L. B. (2014). Ubiquitous learning environment using android mobile application. *International Journal of Research in Engineering and Technology*, *2*(2), 119-128. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.681.508&rep=rep1&type=pdf

Clark-Wilson, A., Robutti, O., & Thomas, M. (2020). Teaching with digital technology. *ZDM - Mathematics Education*, *52*(7), 1223–1242. https://doi.org/10.1007/s11858-020-01196-0

Dwiranata, D., Pramita, D., & Syaharuddin, S. (2019). Pengembangan media pembelajaran matematika interaktif berbasis android pada materi dimensi tiga kelas X SMA. *Jurnal Varian*, *3*(1), 1–5. https://doi.org/10.30812/varian.v3i1.487

Ejikeme, A. N., & Okpala, H. N. (2017). Promoting children's learning through technology literacy: challenges to school librarians in the 21st century. *Education and Information Technologies*, *22*(3), 1163–1177. https://doi.org/10.1007/s10639-016-9481-1

Fuys, D., Geddes, D., & Tischler, R. (1988). The Van Hiele model of thinking in geometry among adolescents. *Journal for Research in Mathematics Education*, *3*, 1-196. https://doi.org/10.2307/749957

Handayani, I. M, & Sulisworo, D. (2021). Pengembangan media pembelajaran matematika berbantuan development of GeoGebra-assisted mathematics learning media on geometry transformation materials. *Jurnal Equation*, *4*(1), 47–59. https://ejournal.iainbengkulu.ac.id/index.php/equation/article/view/4027

Hendriawan, M. A., & Septian, A. (2019). Pengembangan jimath sebagai multimedia pembelajaran matematika berbasis android untuk siswa sekolah menengah atas. *IndoMath: Indonesia Mathematics Education*, *2*(1), 45. https://doi.org/10.30738/indomath.v2i1.2785

Jelatu, S., Sariyasa, & Ardana, I. M. (2018). Effect of GeoGebra-aided react strategy on understanding of geometry concepts. *International Journal of Instruction*, *11*(4), 325–336. https://doi.org/10.12973/iji.2018.11421a

Kozma, R. B. (1991). Learning with media. *Review of Educational Research*, *61*(2), 179–211. https://doi.org/10.3102/00346543061002179

Lambert, V. A., & Lambert, C. E. (2012). Qualitative descriptive research: An

acceptable design. *Pacific Rim International Journal of Nursing Research*, *16*(4), 255–256. http://antispam.kmutt.ac.th/index.php/PRIJNR/article/download/5805/5064

Lubis, I. R., & Ikhsan, J. (2015). Pengembangan media pembelajaran kimia berbasis android untuk meningkatkan motivasi belajar dan prestasi kognitif peserta didik SMA. *Jurnal Inovasi Pendidikan IPA*, *1*(2), 191-201. https://doi.org/10.21831/jipi.v1i2.7504

Lutvaidah, U. (2016). Pengaruh metode dan pendekatan pembelajaran terhadap penguasaan konsep matematika. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *5*(3), 279–285. https://doi.org/10.30998/formatif.v5i3.653

Mertler, C. A. (2016). Quantitative research method. In: Mertler, C. A. (Ed.) *Introduction to educational research*. Thousand Oaks, CA: SAGE Publications, Inc.

Nahdi, D. S. (2019). Keterampilan matematika di abad 21. *Jurnal Cakrawala Pendas*, *5*(2), 133–140. https://doi.org/10.31949/jcp.v5i2.1386

Novaliendry, D., Darmi, R., Hendriyani, Y., Nor, M., & Azman, A. (2020). Smart learning media based on android technology. *International Journal of Innovation, Creativity and Change.*, *12*(11), 715–735. https://www.ijicc.net/images/vol12/iss11/121109_Novaliendry_2020_E_R.pdf

Rahmi, A., Armiati, A., & Syarifuddin, H. (2021). Tahap preliminary research pengembangan media pembelajaran berbasis komputer pada materi transformasi SMA/MA. *Jurnal Riset Pendidikan Matematika Jakarta*, *3*(1), 14–18. https://doi.org/10.21009/jrpmj.v3i1.5695

Rogers, R., Lombardo, J., Mednieks, Z., & Meike, G. B. (2009). *Android application development*. O'Reilly Media, inc.

Sholikhah, A. (2016). Statistik deskriptif dalam penelitian kualitatif. *Komunika: Jurnal Dakwah Dan Komunikasi*, *10*(2), 342–362. https://doi.org/10.24090/komunika.v10i2.953

Susilana, R., & Riyana, C. (2009). *Media pembelajaran: Hakikat, pengembangan, pemanfaatan, dan penilaian*. Bandung: CV Wacana Prima.

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21 st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, *44*(3), 299–321. https://doi.org/10.1080/00220272.2012.668938

Wah, L. K. (2015). The effects of instruction using the arcs model and GeoGebra on upper secondary students' motivation and achievement in learning combined transformation. *Asia Pacific Journal of Educators and Education*, *30*, 141–158. http://eprints.usm.my/34771/

Wassie, Y. A., & Zergaw, G. A. (2019). Some of the potential affordances, challenges and limitations of using GeoGebra in mathematics education. *Eurasia Journal of Mathematics, Science and Technology Education*, *15*(8), 1-11. https://doi.org/10.29333/ejmste/108436

Yektyastuti, R., & Ikhsan, J. (2016). Pengembangan media pembelajaran berbasis android pada materi kelarutan untuk meningkatkan performa akademik siswa SMA. *Jurnal Inovasi Pendidikan IPA*, *2*(1), 88-99. https://doi.org/10.21831/jipi.v2i1.10289

Zainiyati, H. S. (2017). *Pengembangan media pembelajaran agama islam berbasis ICT*. Jakarta: Kencana.