ISSN 2614-5103 (Print)
2614-5111 (online)
IndoMath
Indonesia Mathematics Education
https://indomath.org/index.php/indomath
Vol 5, No. 2, August 2022, pp. 99 – 108

The Effectiveness of Google Meet on Mathematics Problem Solving Ability of Class XI Students

Ellen proborini
Sekolah Tinggi Teknik Pati, Central Java, Email: ellenproborini@gmail.com

Uli Ulfa
Universitas Pembangunan Nasional Veteran, Yogyakarta

ABSTRACT

The purpose of this study was to determine the effectiveness of Google Meet on students' mathematical problem solving abilities. The population of this study were students of class XI SMK Tunas Harapan Pati for the 2020/2021 academic year. This study uses a quantitative research method with an experimental method, where the treatment is only carried out once in the sample class which is estimated to be able to have an influence on learning outcomes. Data collection techniques using documentation and test methods. The results showed that the problem solving ability of students was more effective if it was done using google meet in learning mathematics on the opportunity material for students of class XI APL Vocational High School Tunas Harapan Pati. This is evidenced by the increase in value from 669.57 to 78.

Keywords: Effectiveness, Google Meet, Problems, Mathematics.

ABSTRAK

Tujuan dari penelitian ini adalah untuk mengetahui keefektivan google meet terhadap kemampuan pemecahan masalah matematika peserta didik. Populasi penelitian ini adalah peserta didik kelas XI SMK Tunas Harapan Pati Tahun Ajaran 2020/2021. Penelitian ini menggunakan metode penelitian kuantitatif, dimana treatment hanya dilakukan satu kali pada kelas sampel yang diperkirakan sudah mampu memberikan pengaruh terhadap hasil belajar. Teknik pengumpulan data menggunakan metode dokumentasi dan tes. Hasil penelitian menunjukkan bahwa kemampuan pemecahan masalah peserta didik lebih efektif jika dilakukan menggunakan google meet dalam pembelajaran matematika pada materi peluang peserta didik kelas XI APL SMK Tunas Harapan Pati. Hal ini dibuktikan dengan adanya kenaikan nilai dari 69,57 menjadi 78.

Kata Kunci: Keefektifan, *Google Meet*, Masalah, Matematika.

INTRODUCTION

Education is translated into the act of transferring information from teachers to students that occurs in the classroom and is carried out formally (Kartikasari., 2016). Education is not only done to achieve learning outcomes, but how to obtain results or learning processes that occur in students (Sitorus et al, 2019; Purwati et al, 2018). Herskovits in Tanis (2013) states that learning does not always occur in a classroom, obtaining education can be done anywhere and anytime to obtain useful knowledge. In other words, education is an effort to expand knowledge in shaping values, attitudes, or behavior (Zsóka et al, 2013; Manfredo et al, 2017). Humans will find it difficult to develop and even

be retarded without education (Tanis, 2013). So far, education is categorized as an active and planned activity, so education is an act or conscious action so that there will be changes in attitudes and expected behavior, namely the formation of a good and whole human being (Chi & Wylie, 2014).

The era of the industrial revolution 4.0 has challenges as well as opportunities for educational institutions. The expected education system is a system that can create students who are able to think critically and solve problems, be creative and innovative and skilled in communication and collaboration with skills in finding, managing and conveying information as well as skilled at using information and technology (Risdianto, Eko., 2019). Minister of Education and Culture (Kemendikbud) Nadiem Anwar Makarim in 2019 sparked the concept of "Free Education for Learning" which is a response to the needs of the education system in the era of the industrial revolution 4.0 where freedom of learning is freedom of thought. This freedom of thought is determined by the teacher, so the main key to supporting the education system is the teacher. Teachers know that everyone has different needs, but uniformity trumps diversity as a basic principle of bureaucracy.

At this time there are still many SMK Tunas Harpan pati's teachers who have not optimally utilized technology in learning. There are still many teachers who use conventional systems in learning such as in giving assignments that still use paper (Margarinda & Elena, 2011; Sobrie et al, 2013; Yen et al, 2018). Even though it is known that educators are the key in learning who should strive to innovate to achieve progress in the field of education (Serdyukov, 2017). One of the efforts to achieve progress in the field of education is by utilizing the development of digital technology (Martín-Gutiérrez et al, 2017; Verawati et al, 2022). The use of digital technology in learning can allow students and teachers to be in different places during the learning process, so that learning can be carried out effectively and efficiently (Milman, 2015; Spector, 2014).

When the Covid-19 pandemic has entered Indonesia, this has greatly impacted the existing education system (Kuncoro et al, 2022; Istiqomah & Widodo, 2021). Covid-19 is an abbreviation of "coronavirus disease 2019" or a disease caused by the corona virus in 2019. This Covid-19 outbreak has a very high and fast rate of spread that attacks the human immune and respiratory systems (Rothan & Byrareddy, 2020). Based on the Joint Decree of the Ministry of Education and Culture, Ministry of Religion, Ministry of Health and Ministry of Home Affairs that education units can carry out face-to-face learning if they are in the green zone (Aminah, 2020; Widodo et al, 2022). This means that educational units located in the yellow, orange and red zones continue to carry out online learning. In situations like this, teachers are required to be more creative and able to take advantage of existing technology so that online learning is not just providing a summary of materials and assignments through social media. The use of learning media that utilizes ICT can make learning mathematics easier and more interesting (Widjayanti et al, 2018). However, in reality, students have not been able to use ICT optimally in learning mathematics (Lince, 2016). Students have difficulty understanding and solving problems from the modules attached by the teacher, so they need media to do virtual learning (Wijayanti et al, 2022; Widodo, 2018).

There are several learning media that can be used for virtual learning in the current pandemic era, including virtual classes and video conferencing. Virtual Class is a learning concept that consists of a group/class where the participants simultaneously participate in distance learning from the

location where they are connected to the same platform (Raes et al., 2020). Video conferencing is an integration of audio and video in full screen mode, where users can communicate with each other, share screens and can face each other virtually (Ekawardhana, 2020). Virtual classes and video conferences are carried out with the help of a smartphone connected to the internet which is a medium for mobile learning. Mobile learning is one of the uses of information and communication technology for interactive learning media in the learning process, so that the learning process of students can be interesting and not limited by space and time (Suprihatiningsih et al., 2020). Several virtual classes that can be used in distance learning are Edmodo, Edpuzle, Google Classroom, Schoology, but there are also schools that have developed their own Learning Management System (Irfan et al, 2020). In addition to virtual classrooms, online learning can be done using video conferencing applications such as Google Meet, Zoom, Webex and so on. The application can be used on smartphones owned by the majority of students as a supporter of online learning.

In this study, video conferencing is used in the form of Google Meet, where this feature has been integrated with Google Classroom which has previously been used in learning. Google Meet is an application that provides the facility to make conferences between users via video calls (Rustaman, 2020). Google meet is an application or vicon software developed by Google that can be used for the online learning process. The advantages of Google Meet according to (Idcloudhost, 2020) are (a) helping workers and employees to stay in meetings wherever they are by using video calls, (b) a unique and functional interface with a light and fast size, prioritizing efficient, user-friendly management that can be followed by all participants, and (c) users can invite meeting participants and share features.

Mathematics learning that is carried out using Google Meet will more or less affect the success of students in understanding a material. According to the National Council of Teachers Mathematics (NTCM) there are five competencies in mathematics learning, namely mathematical problem solving, mathematical reasoning, mathematical communication, mathematical connection, and mathematical representation (Perwitasari & Surya, 2017; Dewi & Kusumah, 2014; Widodo et al, 2019; Widodo, 2020), . A combination of these five competencies needs to be possessed by students in order to be able to use mathematics in everyday life (Suryaprani et al, 2016). Permendikbudristek Number 5 of 2022 states that graduate competency standards of students have the ability to find solutions and analyze collaborative problems, convey original ideas, make creative actions and works, and have the ability to collaborate. Critical thinking is one of the demands for the graduation of students in their education. However, today's teaching and learning activities have not developed students to be able to think critically. In general, students have not applied a critical attitude when facing problems related to everyday life. Students can work on questions correctly and well, but are not necessarily able to apply their critical attitude when faced with questions related to everyday problems.

Baki in Ersoy & Guner (2015) states that students must have the ability to solve problems. Krulik and Rudnick in Carson (2007) define problem solving as a way in which a person uses previously acquired knowledge, abilities, and understanding to fulfill a situation. Karatas & Baki (2013) state that problem solving is the ability to analyze, interpret, give reasons, predict, evaluate,

and reflect. Therefore, in learning mathematics, students need to be given space to develop critical thinking skills in solving problems. Problem solving steps according to Polya, namely understanding the problem, making solution plan, implement the solution plan, and re-examine the results (Septian, 2022; Ibrahim et al, 2021).

Peter (2012) states that to improve problem solving skills, students must be able to think critically. Having knowledge or information alone is not enough to be effective in work and personal life. Students must be able to solve problems to make effective decisions (Widodo et al, 2019; Widodo & Ikhwanudin, 2018). Hodges (2012) states that being a successful global citizen requires the ability to solve problems, especially in the modern era. In this era, students are required to be able to solve problems scientifically. Scientific thinking skills in Bloom's Taxonomy include several steps including remembering previous knowledge, understanding problems, using procedures, analyzing, assessing errors and accuracy, and forming hypotheses and procedures (Budiyono, 2015). The problem solving process in this study uses 3 stages, namely identification: understanding the problem by interpreting and examining the problem; analysis: making a solution plan by combining information to formulate a problem and determine a solution method; and evaluation: implementing the solution plan and re-examining the results by applying methods, checking answers, and drawing conclusions. Based on this, this study aims to determine the effectiveness of the use of google meet on the mathematical problem solving abilities of students in class XI SMK Tunas Harapan Pati.

METHOD

This study uses quantitative research methods with experimental methods. This method aims to determine the effect of the independent variables and the dependent variable from the experimental class and control class (Arikunto, 2014). The dependent variable in this study is the problem solving ability of students while the independent variable is the use of google meet in learning. The hypothesis in this study is "the use of google meet is effectively used in learning in an effort to improve the mathematical problem solving ability of class XI students". Learning is said to be effective if it meets the criteria of (1) students' learning completeness, (2) active students in learning, (3) student responses to learning, (4) increasing mathematics learning outcomes after the experiment is carried out (Wahyudin & Nurcahya, 2018; Widodo, 2015).

The subjects of this study were students of class Analisis Pengujian Laboratorium (APL) XI SMK Tunas Harapan Pati. Sampling used cluster random sampling technique and selected class XI APL 1 amounting to 35 students as the experimental class and XI APL 2 totaling 36 students as the control class. Research data were collected using documentation and test techniques. The documentation method in this study was used to obtain data regarding the names of students in class XI APL 1 and 2 as objects of research, to obtain information about geographic location, profiles and documentation when learning took place at SMK Tunas Harapan Pati. The test method used in this study is the opportunity material with a total of 5 questions about the description. The questions were first tested for validity, reliability, discriminatory power and level of difficulty to determine whether or not it was appropriate to be used as a test instrument. Furthermore, the data that has been obtained

is analyzed to determine the normal and homogeneous data. Then the data that were declared normal and homogeneous were analyzed using t-test to find out whether there was a difference in the average student learning outcomes.

RESULT AND DISCUSSION

This research was conducted at SMK Tunas Harapan Pati and researchers conducted research on the effectiveness of google meet on math problem solving abilities in the APL department. The results of the prerequisite test on the initial ability data can be concluded that the sample comes from a population that is normally distributed and has the same variance. Researchers used two classes, namely XI APL 1 as the experimental class and XI APL 2 as the control class, which consisted of a total of 71 students. In the experimental class, students were given learning by researchers with the help of google meet media with Opportunity material. For the control class with the same KD, students are given lessons by the teacher related to the help of the google classroom media. The researcher conducted a pre-test and post-test on the probability material. The results of the pre-test and post-test can be seen in table 1 below.

Table 1. Experimental and Control Class Pre-Test Results

Component	Pre-Test Result	
	Experiment Class	Control Class
Number of Students	35	36
The highest score	100	100
The Lowest score	40	40
Average	69.57	68.75
Standard Deviation	17.42	16.32
Homogeneity Test Results	Homogen	

Based on the data presented in Table 1, it can be seen that the average value in the experimental class is 69.57 which is higher than the control class, which is 68.75. The average value of the two classes is low because both are still below 75 as the KKM. Judging from the homogeneity test, the two classes are homogeneous, this means that both classes have the same initial ability. The post-test results of the experimental and control classes on the probability material can be seen in Table 2.

Table 2. Experimental and Control Class Post-Test Results

Component	Post-Test Result	
	Experiment	Control Class
Number of Students	35	36
The highest score	100	100
The Lowest score	40	40
Average	78.00	71.00
Standard Deviation	16.23	15.54
Homogeneity Test Results	Homogen	
T-test	t count > t table, Ho is rejected	

The post-test results in Table 2 above show that the average value of the experimental class is 78.00, which is higher than the average of the control class, which is 71.00. The results shown indicate that both classes have increased. Based on the analysis of the data in Tables 1 and 2, it shows that the use of google meet helps improve students' ability to solve problems. This is indicated

by the increase in student learning outcomes in the experimental class. This is in accordance with research conducted by Pernantah et al (2021) regarding the effectiveness of using Google Meet during online learning, where the use of Google Meet is considered more effective with a percentage of 56.3%.

The results of the post-test were then calculated for normality using the chi-square formula and it was found that both classes were in normal condition. This means testing the hypothesis using parametric statistics. The results of the calculation of the homogeneity test showed that the two classes were homogeneous, meaning that the parametric statistics used were t-test at a significant level of 5%. Hypothesis testing using t-test obtained t-count = 1.827, greater than t-table = 1.645. This means that the use of Google Meet is more effective in solving the problems of class XI students at SMK Tunas Harapan Pati.

The experimental class that was treated by using google meet to solve the given problem was more effective than the control class that was given conventional learning using google classroom. Students in the experimental class are active in collecting complete data in order to solve the problems they face. At the beginning of learning, students are given problems in the student activity sheet related to the opportunity material being taught. The problems presented to students can arouse students' understanding of existing problems, the knowledge they have, their desire to solve problems, and build the spirit that they are able to solve problems. Therefore, by providing problems at the beginning of learning can encourage students to think more actively to find solutions to the problem. With the problems that must be solved in the given learning, students are required to determine the answers according to the initial abilities possessed by each.

Learning carried out in the experimental class requires students to be actively involved in solving the problems given and trying to solve them according to what they experience and know. Students seek information about the opportunity material with the process of solving problems by identifying the problem then understanding and analyzing the problem. During the learning process, students can observe the suitability between the results of the answers and the facts that occur related to the problems to be solved. This can strengthen students' knowledge of the opportunity material being studied. If students' answers related to the problem are in accordance with the facts that occurred during the learning process, then this can strengthen students' understanding of the opportunity material. Vice versa, if the answers made by students are not in accordance with the facts that occurred during the learning process, then this can provide students with the correct understanding. The understanding gained through this learning activity can build students' knowledge, because students are actively involved in learning to solve problems. In accordance with research conducted by Syazali (2015) which concluded that problem solving skills can help students to build knowledge in the learning process.

The data that has been obtained by students through learning activities is then processed to answer questions that have been made in the student activity sheet. The questions given have been designed so that students are directed to the correct final conclusion. Regarding this question, students are required to work on the questions given with a coherent and appropriate completion process. The results of activities that have been completed can be delivered with a presentation by

one of the students via a sharescreen on the Google Meet application and responded by other students. The results of the answers that have been submitted will provide opportunities for students to exchange information. In addition, the shortcomings of each student regarding opportunity material can be identified and used for joint learning. The teacher can give the correct final conclusion at the end of the lesson. Students gain knowledge related to the problems presented at the beginning of learning, so that students can answer these problems more precisely.

The explanation above is in accordance with the theory which states that problem-based learning provides opportunities for students to collect and analyze complete data in solving the problems they face. Therefore, students can build their own concepts that they learn, and can develop their thinking skills based on problem solving. The essence of this learning is solving existing problems related to learning material, not how the teacher explains one way of the learning material presented. In problem-based learning, students are required to work together in groups so that there is an exchange of ideas to solve problems (Huda, 2013). On the other hand, the problem-based learning model with the experimental method used presents an original experience that encourages students to learn actively, construct knowledge, and integrate the context of learning in school and learning in real life scientifically (Abidin, 2014).

CONCLUSION

Based on the results of research and discussion, it can be concluded that students' problem solving abilities are more effective if done using google meet. In this study, the use of google meet was applied in learning mathematics in class XI APL opportunity material at SMK Tunas Harapan Pati. The results showed an increase in the average score of students from 669.57 to 78. This proves that using google meet has an effect on the mathematical problem solving abilities of students in class XI APL SMK Tunas Harapan Pati. This research can be developed by combining the use of google meet using other learning applications such as Math tricks, Mathway, Qanda and others.

ACKNOWLEDGEMENT

Thanks to the students who were directly involved in this research. Likewise, we would like to thank LPPM of the Sekolah Tinggi Teknik Pati (STTP) which has provided support for the implementation of this research, as well as to the Principal and Mathematics Subject Teachers of SMK Tunas Harapan Pati who have allowed to carry out this research.

REFERENCES

Abidin, Y. (2014). Desain Pembelajaran dalam Konteks Kurikulum 2014. Bandung. PT Refika Aditama.

Aminah, A., N. (2020). *Selain di Zona Hijau, Sekolah Dilarang Tatap Muka*. https://republika.co.id/berita/qc29wu384/mendikbud-selain-di-zona-hijau-sekolah-dilarang-tatap-muka

Arikunto, S. (2014). Dasar-dasar Evaluasi Pendidikan Edisi Revisi. Jakarta: Bumi Aksara

Budiyono. (2015). Pengantar Penilaian Hasil Belajar. Surakarta: UPT UNS Press.

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational psychologist*, *49*(4), 219-243.

Depdiknas. (2006). Peraturan Menteri Pendidikan Nasional Republik Indonesia. Standar Kompetensi Lulusan untuk Satuan Pendidikan Dasar dan Menengah.
Dewi, N. R., & Kusumah, Y. S. (2014). Developing test of high order mathematical thinking ability in integral calculus subject. *International Journal of Education and Research*, *2*(12), 101-108.
Ersoy, E., & Guner, P. (2015). The Place of Problem Solving and Mathematical Thinking in The Mathematical Teaching. The Online Journal of The Horizon in Education.Vol. 5, No. 1, pp. 120-130.
Ekawardhana, N.E. (2020). Efektivitas Pembelajaran dengan Menggunakan Media Video Conference . Seminar Nasional Ilmu Terapan IV. Pp 1-7
Hodges, N., J. (2012). Integrating Writing with Contemporary Mathematics to Develop Critical Thinking Skills. National Conference of The American Society for Engineering Education. Texas.
Huda, M. (2013). Model-Model Pengajaran dan Pembelajaran Isu-Isu Metodis dan Pragmatis. Yogyakarta: Pustaka Pelajar.
Idcloudhost. (n.d.). Mengenal Google Meet : Fitur, Keunggulan, dan Cara Menggunakannya. Idcloudhost. https://idcloudhost.com/mengenal-google-meet-fitur-keunggulan-dan-cara-menggunakannya/
Ibrahim, I., Sujadi, I., Maarif, S., & Widodo, S. A. (2021). Increasing Mathematical Critical Thinking Skills Using Advocacy Learning with Mathematical Problem Solving. *Jurnal Didaktik Matematika*, *8*(1), 1-14.
Irfan, M., Kusumaningrum, B., Yulia, Y., & Widodo, S. A. (2020). Challenges during the pandemic: use of e-learning in mathematics learning in higher education. *Infinity Journal*, *9*(2), 147-158.
Istiqomah, N., & Widodo, S. A. (2021). Efektivitas Penggunaan Video Pembelajaran dalam Upaya Meningkatkan Minat dan Hasil Belajar Peserta Didik pada Pembelajaran Matematika di Masa Pandemi Covid-19. In *Seminar Nasional Pendidikan Sultan Agung* (Vol. 2, No. 1).
Kartikasari, G. (2016). Pengaruh Media Pembelajaran Berbasis Multimedia Terhadap Motivasi Dan Hasil Belajar Materi Sistem Pencernaan Manusia: Studi Eksperimen pada Peserta didik Kelas V MI Miftahul Huda Pandantoyo. Jurnal Dinamika Penelitian: Media Komunikasi Penelitian Sosial Keagamaan,16(1), 59-77.
Karatas, I. and Baki, A. (2013). The Effect of Learning Environments Based on Problem Solving on Students' Achievements of Problem Solving. International Electronic Journal of Elementary Education, Vol 5, No. 3, pp. 249-268.
Kuncoro, K. S., Sukiyanto, S., Irfan, M., Amalia, A. F., Pusporini, W., Wijayanti, A., & Widodo, S. A. (2022). Peningkatan Literasi Digital Guru Guna Mengatasi Permasalahan Pembelajaran di Era Pandemi Covid-19. *Abdi Wiralodra: Jurnal Pengabdian Kepada Masyarakat*, *4*(1), 17-34.
Lince, R. (2016). Creative thinking ability to increase student mathematical of junior high school by applying models numbered heads together. *Journal of Education and Practice*, *7*(6), 206-212.
Manfredo, M. J., Bruskotter, J. T., Teel, T. L., Fulton, D., Schwartz, S. H., Arlinghaus, R., ... & Sullivan, L. (2017). Why social values cannot be changed for the sake of conservation. *Conservation Biology*, *31*(4), 772-780.
Margarinda Romero & Elena Barbera. (2011). "Quality of Learners" Time and Learning Performance beyond Quantitative Time on Task, Time Flexibility in E-Learning. The international Review of Reaserch in Open & Distance Learning. 12(5).
Martín-Gutiérrez, J., Mora, C. E., Añorbe-Díaz, B., & González-Marrero, A. (2017). Virtual technologies trends in education. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(2), 469-486.
Milman, N. B., (2015). Distance Education in International Encyclopedia of The Social and Behavioral Sciences : Second edition.
Pernantah P.S., Nova, dan Ramadhani, A.S. (2021). Penggunaan Aplikasi Google Meet dalam Menunjang Keefektifan Belajar Daring Masa Pandemi Covid-19 di SMA Negeri 3 Pekanbaru. *Jurnal Ilmu pendidikan*. Vol 21. No.1, pp45-50.
Peraturan Mentri Pendidkan, Kebudayaan, Riset dan Teknologi No. 5 Tahun 2022 tentang SKL PAUD dan Dikdasmen
Perwitasari, D., & Surya, E. (2017). The development of learning material using problem based learning to improve mathematical communication ability of secondary school students. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, *33*(3), 200-207.
Peter, E., E. (2012). Critical Thinking: Essence for Teaching Mathematics and Mathematics Problem Solving Skills. Journal of African Journal of Mathematics and Computer Science Research. Vol. 5, No. 3, pp. 39-43.

Purwati, N., Zubaidah, S., Corebima, A. D., & Mahanal, S. (2018). Increasing Islamic Junior High School Students Learning Outcomes through Integration of Science Learning and Islamic Values. *International Journal of Instruction*, *11*(4), 841-854.

Raes, et al. (2020). Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes. Computers and Education, 143(August 2019), 103682.

Risdianto, Eko. (2019). *Kepemimpinan dalam Dunia Pendidikan di Indonesia di Era Revolusi Industri 4.0*. retrieved at https://www.researchgate.net/publication/332423142.

Rothan, H. A., & Byrareddy, S. N. (2020). The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. Journal of Autoimmunity. https ://doi.org/ 10.1016/j.jaut.2020.102433

Rustaman, A.H. (2020). Efektivitas Penggunaan Aplikasi Daring, Video Conference, dan Sosial Media pada Mata Kuliah Komputer Grafis I di Masa Panademi Covid-19. Jurnal Ilmu Sosial dan Pendidikan. Vol. 4 no. 3. Pp 557-562.

Septian, A., Widodo, S. A., Afifah, I. N., Nisa, D. Z., Putri, N. P. K., Tyas, M. D., ... & Andriani, A. (2022). Mathematical Problem Solving Ability in Indonesia. *Journal of Instructional Mathematics*, *3*(1), 16-25.

Serdyukof, P. (2017). Innovation in Education: What Works, What Doesn't and What to Do About it?. Journal of Research in Innovative Teaching and Learning, 10(1) : 4-33.

Sitorus, H. V., Nugrahadi, E. W., & Budiarta, K. (2019). The effect of learning strategy and thinking ability on the students' learning outcomes in economics subject of xi social students in senior high school state 1 in pematang siantar. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, *2*(4), 451-460.

Sobrie, O., Mousseau, V., & Pirlot, M. (2013, November). Learning a majority rule model from large sets of assignment examples. In *International conference on algorithmic decision theory* (pp. 336-350). Springer, Berlin, Heidelberg.

Spector, J. M. (2014). Conceptualizing the emerging field of smart learning environments. *Smart learning environments*, *1*(1), 1-10.

Suprihatiningsih,S., Sudibyo, N.A., dan Harmini, T. (2020). Eksperimentasi Mobile Learning pada Mata Kuliah Kalkulus Integral Ditinjau Dari Kemampuan Bekerjasama. Buana Matematika : Jurnal Ilmiah Matematika Dan Pendidikan Matematika, 10(1), 17–30.

Suryaprani, M. W., Suparta, I. N., & Suharta, I. G. P. (2016, August). Hubungan jenis kelamin, literasi matematika, dan disposisi matematika terhadap prestasi belajar matematika peserta didik SMA Negeri di Denpasar. In *Prosiding Seminar Nasional MIPA*.

Syazali, M. (2015). Pengaruh Model Pembelajaran Creative Problem Solving Berbantual Maple II terhadap Kemampuan Pemecahan Masalah Matematis. Jurnal Pendidikan Matematika. Vol. 6 no 1, pp. 91-98.

Tanis, H. (2013). Pentingnya Pendidikan Character Building dalam Membentuk Kepribadian Mahapeserta didik. HUMANIORA, 4(2), 1212-1219

Verawati, A., Agustito, D., Pusporini, W., Utami, W. B., & Widodo, S. A. (2022). Designing Android learning media to improve problem-solving skills of ratio. *Advances in Mobile Learning Educational Research*, *2*(1), 216-224.

Wahyuddin & Nurcahya. (2018). Efektivitas Pembelajaran matematika melalui Pembelajaran Aktif tipe *everyone is a teacher here* (ETH) Pada siswa kelas X SMA Negeri 8 Takalar. *Jurnal pendiidkan dan Peneblajaran Matematika*. Vol. 2 no.1, pp 72-105

Widodo, S. A. (2015). Keefektivan team accelerated instruction terhadap kemampuan pemecahan masalah dan prestasi belajar matematika siswa kelas VIII. Kreano. *Jurnal Matematika Kreatif-Inovatif*, *6*(2), 127-134.

Widodo, S. A. (2018). Selection of Learning Media Mathematics for Junior School Students. *Turkish Online Journal of Educational Technology-TOJET*, *17*(1), 154-160.

Widodo, S. A. (2020). *Pengembangan Mathematical Comic Untuk Pencapaian Kemampuan Pemecahan Masalah Matematis Dan Konfirmasi Norma Sosiomatematika* (Doctoral dissertation, Universitas Pendidikan Indonesia).

Widodo, S. A., & Ikhwanudin, T. (2018). Improving mathematical problem solving skills through visual media. In *Journal of Physics: Conference Series* (Vol. 948, No. 1, p. 012004). IOP Publishing.

Widodo, S. A., Nayazik, A., & Prahmana, R. C. I. (2019, March). Formal student thinking in mathematical problem-solving. In *Journal of Physics: Conference Series* (Vol. 1188, No. 1, p. 012087). IOP Publishing.

Widodo, S.A., Amalia, A.F., Sukiyanto, S., Irfan, M., Kuncoro, K.S. (2022). Pendampingan Pembelajaran Tatap Muka Terbatas Berbasis Sosiograph untuk Meningkatkan Kemampuan Literasi pada Guru Sekolah Menengah. *Jurnal Solma*. 11(1)

Widjayanti, W. R., Masfingatin, T., & Setyansah, R. K. (2018). Media Pembelajaran Interaktif Berbasis Animasi Pada Materi Statistika Untuk Peserta didik Kelas 7 Smp. *Jurnal Pendidikan Matematika*, 13(1), 101–112.

Wijayanti, N., Arigiyati, T. A., Aulia, F., & Widodo, S. A. (2021). Development of E-Worksheet on Linear Equations and Inequalities Topics Based on Tri-N. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang*, *5*(2), 245-260.

Yen, S. C., Lo, Y., Lee, A., & Enriquez, J. (2018). Learning online, offline, and in-between: comparing student academic outcomes and course satisfaction in face-to-face, online, and blended teaching modalities. *Education and Information Technologies*, *23*(5), 2141-2153.

Zsóka, Á., Szerényi, Z. M., Széchy, A., & Kocsis, T. (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. *Journal of cleaner production*, *48*, 126-138.