The Role of Teachers and Communication Information Technology (ICT) Media in the Implementation of Mathematics Learning in the Digital Age

Annisa Nurina Vidyastuti[1], Rani Darmayanti[2], Rahmad Sugianto[3]

[1] Universitas Negeri Malang, Indonesia
[2] Universitas PGRI Wiranegara Pasuruan, Indonesia
[3] Universitas Islam Negeri Sunan Ampel Surabaya, Indonesia

Correspondence Address; ranidarmayanti1990@gmail.com

Abstract

The current era of modernization has brought the Indonesian nation forward in the development of science and technology. This is marked by the existence of information and communication that spreads quickly in life, including in the world of education. Along with the development of ICT, one must also be able to adjust, sort, and utilize the development of information and communication so that it can make a positive contribution to students. The purpose of this study was to describe the role of teachers and information communication technology (ICT) media in the implementation of mathematics learning in the Digital Age. This research is a literature study with a descriptive qualitative research type with a literature review that seeks to describe the role of educational innovation in digital technology-based learning. In this study, the authors used various written sources such as articles, journals, and documents that were relevant to the studies in this study. This Literature Study focuses on the role of a teacher in learning mathematics, digital technology in education, and the use of technology in education, as well as digital-based learning media. Learning has an important role in efforts to improve the quality of education, so that learning can bring meaning and benefits to students. The conclusion in this paper is that ICT mastery is an indicator of a teacher's competence. The selection and use of ICT media must be correlated with learning and adapted to the needs of learning activities.

Keyword: Digital Learning**,** ICT, Learning Media, Teacher Competence

INTRODUCTION

Developments in the current era of modernization are marked by the rapid development of science and technology. This makes information and communication spread very quickly in every line of life, one of which is in the world of education (Park et al., 2017). This encourages changes that must be balanced by education in Indonesia. Almost all lines of our lives need and depend on technology, because technology provides convenience and makes human work more efficient (Munawaroh, 2010; Oktaviyanthi et al., 2017). In the world of education, technology has many benefits that support a more interactive teaching and learning process (Lin et al., 2017; Riwayadi, 2013). However, Indonesia still relies heavily on teachers as the center of educational life. Therefore, with the development of this era, teachers must also be able to *improve* their ability to use technology as a support for learning (Kirana, 2011).

Utilization of ICT in education can improve and optimize skills, so that later they can be applied in various subjects in schools. Each subject has a different curriculum, the existence of this cross-curriculum aims to deal with the development of people's lives towards the era of globalization (Chu et al., 2016; Lee et al., 2016). This is because ICT is one of the primary human needs in this era of globalization. Therefore, students need to be equipped with these skills to make it easier for students to understand the material taught by the teacher (Ramli, 2012). Besides making it easy for students to understand, it is hoped that teachers will also have skills in using and developing learning media. For this reason, teachers also need to have the provision of

knowledge and skills in understanding various types of learning media. This media will later assist teachers in communicating with students to be more interactive so that learning objectives will be achieved easily (Putra et al., 2016; Wanner & Palmer, 2015).

In order to activate the process of modernization and improve the quality of education, changes are needed as well as a breakthrough in the mindset that is driven by teachers in the teaching and learning process. Currently, teachers are required to be able to create learning that is creative, interactive, and fun (Beaver et al., 2015; Munawaroh, 2010). To create these activities, teachers need to have good mastery in the field of technology in carrying out *indoor* or *outdoor* (Candra et al., 2017; Dewi & Hilman, 201). This was done with the aim of stimulating the psychological and physical development of students in the modernization era by utilizing technological developments (DANIM, 2010). Today's teaching and learning process is more inclined towards modernization activities with the help of sophisticated technology. The existence of this technology is expected to make it easier for young children to explore the potential that exists in each student, as well as their interests and talents (Riwayadi, 2013; Sugiyanto et al., 2015; Sumarmo, 2014). It is packaged in an interactive, effective, inspiring, fun, constructive and meaningful way. In addition, through this technology, it is hoped that early childhood will have *life skills* (Hidayat et al., 2013; Sudjana & Rivai, 2001).

Basically, the teaching and learning process that utilizes this technology has a positive impact not only on students but also on teachers. The use of ICT provides opportunities and opportunities for educators to be able to develop and improve their competencies (Febriana, 2019). One of the competencies that can be improved by teachers is pedagogic and professional competence (Idris Dosen Tarbiyah STAI Luqman Al Hakim Surabaya, n.d.). The use of ICT in the teaching and learning process is proclaimed to be able to overcome learning problems that exist in the field. There are several things that become problems in the learning process in the classroom, one of which is the less optimal role of the teacher in utilizing ICT in each process (Vernon S. Gerlach, Donald P. Ely, 1980). One form of effort that can be carried out by teachers in utilizing technology in the education sector is to utilize ICT in learning according to the optimal level of student development (Miftah, 2013).

The hope of using and utilizing information and communication technology (ICT) is to become an alternative solution to contemporary learning. Even though trying to transform to keep up with current learning, these alternatives must still be appropriate to the age of students by paying attention to their characteristics and development (Riwayadi, 2013). Optimizing the use of this technology is one form of effort to stimulate student development to the fullest (Munawaroh, 2010). Therefore, it is hoped that by intensifying the use of ICT in learning, students can understand well the use of technology. Understanding the proper and targeted use of technology can help the teaching and learning process in schools. The real form of utilizing ICT development is to utilize it as a required learning media. The information and communication technologies used are audio-visual media, internet, media players, and computers (Ramli, 2012). This is predicted to be an alternative to creating fun learning for students which of course cannot be separated from the role of the teacher (Munawaroh, 2010). Structure the introduction around your theme (Febriya et al., 2015; Mózo, 2017). The introduction should reflect the state of the art, show the literature gap, and how your study improves the drawbacks of the previous study (Subroto, 2011). Explain any related variables, definitions of key terms, and previous studies of similar themes as the literature review of your study. Conclude this section with your research questions.

RESEARCH METHODE

This research is a qualitative-research using descriptive analysis techniques with literature review. Researchers want to describe the role of a teacher and how to use Information Communication Technology (ICT) media in implementing mathematics learning in the Digital Age. The research was conducted in May 2018. The data collected came from scientific journals related to the role of a teacher in learning mathematics, digital technology in education, and the use of technology in education, as well as digital-based learning media. The data obtained were then analyzed using descriptive analysis methods. The analytical method used is to describe the facts from theoretical studies of research results that have been carried out by previous researchers. This article analyzes the Role of the Teacher and Media Information Communication Technology (ICT) in the Implementation of Mathematics Learning in the Digital Age.

RESULTS AND DISCUSSION

Finding

Teacher Competency

Competency is a combination of several aspects, namely knowledge, skills, values, and behavior that is described by behavior in working and on duty (Rho et al., 2015; Samadi et al., 2015). Another opinion states that competence is a certain ability that is professionally relevant and must be owned by a certain worker to be said to be capable of carrying out tasks in a particular field (Ismail, 2010). Professional nature is characterized by skill, skill, accuracy, and the success of every action. The nature of responsibility must be marked by the accuracy of each task given from the point of view of science, technology and ethics. According to the Government Regulation of the Republic of Indonesia no. 78 of 2008 concerning Teachers states that "*competence is a set of knowledge, skills and behaviors that must be owned, internalized and mastered by teachers or lecturers in carrying out professional tasks*" (Gao et al., 2014; Hakala & Myllymaki, 2016)

Based on several opinions of experts it can be concluded that competence teacher is the knowledge, skills, and abilities possessed by a teacher so that the teacher can carry out activities based on affective, cognitive, and psychomotor. Basically teacher competency standards were created with the aim of producing competent and professional teachers.

Teacher Competency Standards

In general, teachers must be able to fulfill 2 categories, namely having *capability* and *loyalty*. *Capability* here means that teachers must have proficiency in the knowledge they are involved in, know the theory and techniques of good teaching methods starting from planning, implementing, to evaluating. Loyalty here means that the teacher is loyal to all existing assignments regardless of activities in the classroom or outside the classroom. The following are the competencies that must be possessed by teachers according to the Teacher and Lecturer Law and Government Regulation No. 19 of 2005:

   a. Pedagogic Competence: In Law no. 14 of 2005 concerning Teachers and Lecturers it says that pedagogic competence is "the ability to manage student learning". This competency is a competency possessed by the teacher in managing learning (Kirana, 2011; Qian & Clark, 2016).
   b. Personality Competence: Teachers as educators have the main responsibility for teaching, teachers must also have a good personality because later it will affect the results of developing student potential. The good personality that is spread by the teacher will have a positive impact and will be a role model for students and also around. Therefore, the teacher will later become a figure who should be "digugu" and "imitated" which means that

the teacher's words will be listened to by students, and the teacher's behavior will be imitated as a benchmark by students (Putra et al., 2016; Zweig et al., 2015).

c. Social Competence: Social competence is the teacher's skills in communicating orally and in writing as well as social skills that can enter all environments, namely students, parents, educators, and the surrounding environment (Childs et al., 2015; Purboningsih, 2015).

d. Professional Competence: Professional competence is the ability possessed by teachers in understanding a learning material in order to transfer their knowledge to other students in order to master the material being taught (Lonto et al., 2018; Warjanto, 2015)

Functions of ICT

Media Learning media in the teaching and learning process will make learning come alive, more interesting and interactive (Ramli, 2012). Where the purpose of this learning media is to facilitate students' difficulties in understanding the learning material being taught. There are 6 media functions in the learning process, namely: (1) as a teacher's tool to create effective learning (Fuchs et al., 2015), (2) the media is an important partition in a lesson (Kim, 2015), the teacher must be able to develop existing media, (3) the use of media must be adjusted with learning objectives and materials (Pavlovičová & Švecová, 2015), (4) learning media is a learning support tool to attract more students' attention (Herawati, 2015; Soegeng & Dewi, 2015), (5) makes it easier for teachers to convey material and accelerates students understanding the material, (6) the use of media and other equipment the main goal is to make learning activities become more meaningful and qualified (Miftah et al., 2018).

Instructional Media Selection Procedures

There are several principles that need to be considered in the preparation and determination of learning media. The following are important things that teachers need to pay attention to in determining learning media according to Sudjana and Rivai (Sudjana & Rivai, 2001):

a. Accuracy with learning objectives, meaning that all media used and arranged must be adapted to learning objectives so that learning is more directed and structured

b. The suitability of the media with the content of teaching materials, meaning that the media is structured to support the teacher in conveying the material, therefore the media must be in accordance with the concepts, principles, procedures of the material

c. Ease of obtaining media, meaning that the selected media is easy for teachers to use where the media does not cost a lot, and is easy to find.

d. The teacher's skills in utilizing the media, meaning that the existing media must be able to be adapted to the abilities of existing teachers. No matter how good the media is designed, if the teacher cannot use all of it, it will be useless.

e. There is an appropriate time for the use of media, meaning that the media used must be adjusted to the available time allocation so that learning becomes more meaningful.

f. Alignment with students' abilities, meaning that every use of media must consider the extent to which students' thinking abilities are so that the material presented can be understood.

In accordance with what was conveyed by Sudjana and Rivai, Erickson also has an opinion regarding matters that need to be considered in selecting learning media

a. *Instructional Goals,* in the selection of media must be adjusted to the learning objectives that have been prepared in the previous curriculum.

b. *Instructional Content,* meaning that in choosing and also determining the media to be used as a support for learning must be adapted to what material will be taught.

c. *Learner Characteristic,* meaning that here student characteristics are an aspect that also needs to be considered in determining the media. Each student has different

characteristics, as well as learning media. There are 2 characteristics that must be considered, namely quantitatively and also qualitatively. Quantitative here means that the selection of media must be adjusted to the number of students in each class. For qualitative itself, it means that the media must be adjusted to the quality and thinking abilities of students.

d. Media *Selection,* meaning that the selection of media must be done carefully. Each media has its own function according to its portion. The teacher must be smart in choosing, the teacher needs to compare the media with one another so that they can find out the advantages and disadvantages of each learning media.

Agreeing with Erickson, Vernon also stated that in determining the media the teacher can choose it by using the ACTION reference, which stands for; *Access, Cost, Technology, Interactivity, Organization, and Novelty* (Vernon S. Gerlach, Donald P. Ely, 1980).

a. *Access*

The ease of accessing media in the process is the most important thing in choosing learning media. Not all good media are easily accessible, and not all accessible media are in accordance with learning objectives. Therefore it is necessary to consider several things before choosing learning media.

b. *Cost*

Cost is an equally important aspect to consider in choosing the learning media used. Effective and interactive media are not always expensive, teachers can utilize existing objects in the surrounding environment to become an effective learning media but don't spend a lot of budget.

c. *Technology*

In determining technology-based media, what matters is not only how sophisticated the media is, but also the availability of technology in schools. In addition, what is equally important is the ease of use of this technology. For the use of visual media that requires high electrical power, it must be a consideration for the teacher in using it.

d. *Interactivity*

Media is not modern sophisticated media, but good media is media that can create interactive two-way communication in learning.

e. *Organization*

In the implementation of learning, support is needed from all parties in the school. This will greatly affect the quality of existing learning. In selecting media, support from school principals or related foundations is also needed so that its application is easier. This will later affect the ease of access, funding, and also the facilities that will be provided by the school to support teachers.

f. *Novelty*

Novelty is a differentiator of a work that is produced from the works that previously existed. This is applied when the teacher chooses the media to be used, the teacher must consider what updates are offered from the media.

ICT in Mathematics Learning in Indonesia

Mathematics is a subject that is taught at all levels of education where this has the aim of instilling students to think logically, analytically, systematically, and creatively in solving problems. It's no longer unusual that in the field of mathematics this is a lesson that is a scourge for a handful of students, this is because mathematics contains symbols, formulas, and terms that need to be understood and memorized. This makes a handful of students avoid math lessons. Using ICT media is expected to be an alternative for learning mathematics which is considered a scourge

to be a fun lesson. This will make it easier for teachers and students to achieve learning objectives in cognitive, psychomotor, and affective aspects easily (Attridge & Inglis, 2013).

The use of ICT in education is unlimited, everyone has the right to explore ICT for the sake of learning continuity. The development of ICT also demands changes, one of which is the adjustment of the curriculum. Because of this, several new terms emerged such as *e-test, e-learning, e-library*, and so on (Vanden Eng et al., 2015). ICT has a big influence on the education sector, ICT has more or less changed the pattern of learning which was originally *teacher oriented* which slowly became more interactive between teachers and students. This ICT media makes learning more meaningful which makes it easier for teachers to improve student abilities and accommodate student differences in terms of learning. Some students really need this ICT media in understanding a learning material because they are more imaginative and creative (Supianti, 2018). The hope is that the use of this media will be for teachers and students to be able to further explore existing abilities and potentials into great abilities.

The following presents the differences between teachers in teaching and students in learning after ICT has changed more or less the educational process in Indonesia(Fitriyadi, 2015):

Table 1. Changes in the Teacher's Role in Digital-Based Learning

Changes in the Teacher's Role	
Primary source of information, delivered in a lecture	Facilitator in learning
Teacher takes full control in learning	Students are freed to explore what they have independently and responsibility

Table 2. Changes in the Role of Students in Digital-Based Learning

Changes in the Student's Role	
Only as passive recipients of information	Actively looking for learning resources independently, active in every process
Processing information on their own and for their own interests	Discussing with colleagues to solve problems and process information

In learning mathematics at school, the functions of ICT media are grouped into 3 functions, namely (Riwayadi, 2013):

1. Independent learning media, an example of which is included in independent learning media is an interactive CD where students can explore the contents of the media themselves.
2. Learning aids, technology that is used as a learning aid media is software that can be developed into many alternative learning media.
3. Learning resources, are all technology-based learning resources in the form of the internet and all of its contents. The internet is a very large source of information, where all information can be accessed easily there. Examples of information that can be accessed online are: online journals, *online courses*, etc.

Application of learning using *e-learning is* closely related to the use of ICT in learning. ICT media is used as a tool that helps the learning process. It aims to create efficient, attractive, effective, and communicative learning (Miftah et al., 2018). *output* in its application is good learning outcomes and students' skills in communicating in a more effective way that minimizes costs and also labor. The use of ICT in several schools has been supported by adequate computer laboratories and internet access, and there are also a handful of schools that have their own *e-learning* (Supianti, 2018). Several things that have been widely used by teachers in utilizing information technology are: (1) the use of *PowerPoint* in delivering material; (2) giving

assignments or exercises to students by searching for resources via the internet; (3) the use *software* learning support application *GeoGebra, Mathlab*, etc.; (4) some teachers whose schools have *e-larning* have used it in learning but it is not optimal (Supianti, 2018).

CONCLUSION

Based on the presentation of several literature studies that have been conducted, it is confirmed that information and communication technology (ICT) makes a major contribution to the learning process. Structured information and communication technology (ICT) in a teaching and learning system can make it easier for students to understand the material presented by the teacher. A good understanding of the material is expected to generate interest in student learning to play a more active and communicative role in each process. However, the implementation in the field is not as easy as people have imagined. Not only teachers and students play a role in the learning process, but also the role of learning psychology experts, as well as technology experts. The existing components will become strong and produce quality successors to the nation if all of them give their best for Indonesian education. In other words, educators, psychologists, and technology experts are one unit and become a solid team to work hand in hand in order to create learning for students according to expectations and targets.

REFERENCES

Attridge, N., & Inglis, M. (2013). Advanced Mathematical Study and the Development of Conditional Reasoning Skills. *PLoS ONE*, *8*(7). https://doi.org/10.1371/journal.pone.0069399

Beaver, J. K., Hallar, B., Westmaas, L., & Englander, K. (2015). Blended learning: Lessons from best practice sites and the Philadelphia context. *Perc*, *September*, 1–38. http://www.researchforaction.org/wp-content/uploads/2015/11/RFA-PERC-Blended-Learning-Phase-II-Report-September-2015.pdf

Candra, A. I., Zulkardi, Z., & Yusuf, M. (2017). ANALISIS KESULITAN SISWA DALAM MENYELESAIKAN SOAL-SOAl PISA TAHUN 2012 LEVEL 4, 5, DAN 6 DI SMP N 1 INDRALAYA. *Jurnal Pendidikan Matematika*, *11*(2), 43–58. https://doi.org/10.22342/jpm.11.2.2143.

Childs, E., VanOostveen, R., Flynn, K., & Clarkson, J. (2015). Community building in online PBL courses: Instigating criticality. *Higher Education in Transformation Conference, Dublin, Ireland, 2015*, *May*.

Chu, S. K. W., Reynolds, R. B., Tavares, N. J., Notari, M., & Lee, C. W. Y. (2016). 21st century skills development through inquiry-based learning: From theory to practice. *21st Century Skills Development Through Inquiry-Based Learning: From Theory to Practice*, *January*, 1–204. https://doi.org/10.1007/978-981-10-2481-8

DANIM, S. (2010). *MEDIA KOMUNIKASI PENDIDIKAN* (1st ed.). BUMI AKSARA.

Dewi, S. Z., & Hilman, I. (2019). Penggunaan TIK sebagai Sumber dan Media Pembelajaran Inovatif di Sekolah Dasar. *Indonesian Journal of Primary Education*, *2*(2), 48. https://doi.org/10.17509/ijpe.v2i2.15100

Febriana, Dr. R. (2019). *Kompetensi Guru* (Bunga Sari Fatmawati, Ed.; 1st ed.). PT Bumi Aksara.

Febriya, S., Pranata, O. H., & Aprilliya, S. (2015). Pengembangan Lembar Kerja Siswa Pada Materi Keliling Lingkaran Dengan Pendekatan Pembelajaran Matematika Realistik. *PEDADIDAKTIKA: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *2*(2).

Fitriyadi, H. (2015). Integrasi Teknologi Informasi Komunikasi Dalam Pendidikan: Potensi Manfaat, Masyarakat Berbasis Pengetahuan, Pendidikan Nilai, Strategi Implementasi Dan Pengembangan Profesional. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *21*(3), 1–1. https://doi.org/10.21831/jptk.v21i3.3255

Fuchs, Z., Polinsky, M., & Scontras, G. (2015). The differential representation of number and gender in Spanish. *Linguistic Review*, *32*(4). https://doi.org/10.1515/tlr-2015-0008

Gao, H., Hrachowitz, M., Fenicia, F., Gharari, S., & Savenije, H. H. G. (2014). Testing the realism of a topography-driven model (FLEX-Topo) in the nested catchments of the Upper Heihe, China. *Hydrology and Earth System Sciences*, *18*(5). https://doi.org/10.5194/hess-18-1895-2014

Hakala, I., & Myllymaki, M. (2016). From face-to-face to blended learning using ICT. *IEEE Global Engineering Education Conference, EDUCON*, *10-13-April-2016*. https://doi.org/10.1109/EDUCON.2016.7474586

Herawati. (2015). Penerapan Model Pembelajaran Two Stay Two Stray Untuk Meningkatkan Prestasi Belajar Siswa Pada Materi Keliling Dan Luas Lingkaran Di Kelas VI SD Negeri 53 Banda Aceh. *Jurnal Peluang*, *3*(2).

Hidayat, B. R., Sugiarto, B., & Pramesti, G. (2013). DITINJAU DARI GAYA KOGNITIF SISWA (Penelitian dilakukan di SMA Negeri 7 Surakarta Kelas X Tahun Ajaran 2011 / 2012). *Jurnal Pendidikan Matematika Solusi*, *1*(1).

Idris Dosen Tarbiyah STAI Luqman Al Hakim Surabaya, M. (n.d.). Standar Kompetensi Guru Profesional. *Standar Kompetensi Guru Profesional*, 41.

Ismail, Muh. I. (2010). Kinerja Dan Kompetensi Guru Dalam Pembelajaran. *Lentera Pendidikan : Jurnal Ilmu Tarbiyah Dan Keguruan*, *13*(1), 44–63. https://doi.org/10.24252/lp.2010v13n1a4

Kim, H.-S. (2015). An Analysis of Classroom Ecosystem Using Digital Textbook. *Journal of Curriculum and Evaluation*, *18*(3). https://doi.org/10.29221/jce.2015.18.3.109

Kirana, D. D. (2011). PENTINGNYA PENGUASAAN EMPAT KOMPETENSI GURU DALAM MENUNJANG KETERCAPAIAN TUJUAN PENDIDIKAN SEKOLAH DASAR Damax. *Journal of Physics A: Mathematical and Theoretical*, *44*(8), 1689–1699.

Lee, S. W. Y., Liang, J. C., & Tsai, C. C. (2016). Do sophisticated epistemic beliefs predict meaningful learning? Findings from a structural equation model of undergraduate biology learning. *International Journal of Science Education*, *38*(15). https://doi.org/10.1080/09500693.2016.1240384

Lin, Y. W., Tseng, C. L., & Chiang, P. J. (2017). The effect of blended learning in mathematics course. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(3), 741–770. https://doi.org/10.12973/eurasia.2017.00641a

Lonto, A. L., Wua, T. D., Pangalila, T., & Sendouw, R. (2018). Moral work, teaching profession and character education in Forming Students' Characters. *International Journal of Engineering and Technology(UAE)*, *7*(4), 99–103. https://doi.org/10.14419/ijet.v7i4.28.22560

Miftah, M. (2013). Fungsi, Dan Peran Media Pembelajaran Sebagai Upaya Peningkatan Kemampuan Belajar Siswa. *Jurnal Kwangsan*, *1*(2), 95. https://doi.org/10.31800/jurnalkwangsan.v1i2.7

Miftah, M., Mahnun, N., Kulsum, S., Husnul, S., Budiyono, B., Hakim, L., Wahyuni, I., Susanti, & Zulfiana, A. (2018). Pembelajaran, Inovasi Model. *Edukatif : Jurnal Ilmu Pendidikan*, *37*(1), 27–35.

Mózo, B. S. (2017). Efek Pemberitaan Media Massa terhadap Persepsi Masyarakat Tentang Virus Corona (Studi Kasus; Masyarakat di Pamekasan). *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699. https://doi.org/10.1017/CBO9781107415324.004

Munawaroh, I. (2010). Pemanfaatan Teknologi Informasi Dan Komunikasi Untuk Menumbuhkan Kreativitas Dan Kemandirian Belajar. *Jurnal Teknologi Informasi Dan Komunikasi*, 1–10.

Nelson, R., Marone, V., Garcia, S. A., Yuen, T. T., Bonner, E. P., & Browning, J. A. (2021). Transformative Practices in Engineering Education: The Embedded Expert Model. *IEEE Transactions on Education*, *64*(2). https://doi.org/10.1109/TE.2020.3026906

Oktaviyanthi, R., Safaah, E., & Noviana Agus, R. (2017). Pemberdayaan Keterampilan Guru Matematika

dalam Menyusun Bahan Ajar Berbantuan Mathematics Education Software. *Wikrama Parahita:Jurnal Pengabdian Masyarakat*, *1*(1). https://doi.org/10.30656/jpmwp.v1i1.270

Park, T., Pearson, D., & Richardson, G. B. (2017). Curriculum Integration: Helping Career and Technical Education Students Truly Develop College and Career Readiness. *Peabody Journal of Education*, *92*(2). https://doi.org/10.1080/0161956X.2017.1302213

Pavlovičová, G., & Švecová, V. (2015). The Development of Spatial Skills through Discovering in the Geometrical Education at Primary School. *Procedia - Social and Behavioral Sciences*, *186*. https://doi.org/10.1016/j.sbspro.2015.04.189

Purboningsih, D. (2015). Pengembangan Perangkat Pembelajaran dengan Pendekatan Guided Discovery pada Materi Barisan dan Deret untuk Siswa SMK Kelas X. *Seminar Nasional Matematika Dan Pendidikan Matematika UNY 2015*.

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa'i, I. (2016). The Increasing of Students Creative Thinking Ability Through of Inquiry Learning on Students at Grade XI MIA 1 of SMA Negeri Colomadu Karanganyar in Academic Year 2015/2016. *Proceeding Biology Education Conference*, *13*(1).

Qian, M., & Clark, K. R. (2016). Game-based Learning and 21st century skills: A review of recent research. *Computers in Human Behavior*, *63*. https://doi.org/10.1016/j.chb.2016.05.023

Ramli, M. (2012). Media Teknlogi Pembelajaran. In *IAIN Antasari Press*.

Rho, M. J., Jang, K. S., Chung, K. Y., & Choi, I. Y. (2015). Comparison of knowledge, attitudes, and trust for the use of personal health information in clinical research. *Multimedia Tools and Applications*, *74*(7). https://doi.org/10.1007/s11042-013-1772-6

Riwayadi, P. (2013). Pemanfaatan Perkembangan Teknologi Informasi Dan Komunikasi Untuk Kemajuan Pendidikan di Indonesia. *Prosiding The 5th International Conference on Indonesian Studies: "Ethnicity and Globalization,"* 362–371.

Samadi, A., Soder, L., Shayesteh, E., & Eriksson, R. (2015). Static Equivalent of Distribution Grids With High Penetration of PV Systems. *IEEE Transactions on Smart Grid*, *6*(4). https://doi.org/10.1109/TSG.2015.2399333

Soegeng, A. Y., & Dewi, S. K. S. (2015). KEEFEKTIFAN METODE PERMAINAN MONOPOLI MATERI OPERASI HITUNG TERHADAP MINAT DAN HASIL BELAJAR SISWA KELAS I SD NEGERI 1 KEDUNGSUREN KENDAL. *Malih Peddas (Majalah Ilmiah Pendidikan Dasar)*, *3*(1). https://doi.org/10.26877/malihpeddas.v3i1.625

Subroto, E. (2011). *Pengantar Studi Semantik dan Pragmatik*. Cakrawala Media.

Sudjana, N., & Rivai, A. (2001). *Media Pengajaran* (viii). Sinar Baru.

Sugiyanto, S., Kartowagiran, B., & Jailani, J. (2015). PENGEMBANGAN MODEL EVALUASI PROSES PEMBELAJARAN MATEMATIKA DI SMP BERDASARKAN KURIKULUM 2013. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *19*(1). https://doi.org/10.21831/pep.v19i1.4558

Sumarmo, U. (2014). ASESMEN SOFT SKILL DAN HARD SKILL MATEMATIK SISWA DALAMKURIKULUM 2013. *Seminar Pendidikan Matematika Di Sekolah Tinggi Agama Islam Negeri Batusangkar*, *564*, 1–73.

Supianti, I. I. (2018). Pemanfataan Teknologi Informasi dan Komunikasi (TIK) dalam Pembelajaran Matematika. *MENDIDIK: Jurnal Kajian Pendidikan Dan Pengajaran*, *4*(1), 63–70. https://doi.org/10.30653/003.201841.44

Vanden Eng, J. L., Chan, A., Abílio, A. P., Wolkon, A., Ponce De Leon, G., Gimnig, J., & Morgan, J. (2015). Bed net durability assessments: Exploring a composite measure of net damage. *PLoS ONE*, *10*(6). https://doi.org/10.1371/journal.pone.0128499

Vernon S. Gerlach, Donald P. Ely, R. M. (1980). *Teaching and Media* (2nd ed.). Prentice-Hall.

Wanner, T., & Palmer, E. (2015). Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course. *Computers and Education*, *88*, 354–369. https://doi.org/10.1016/j.compedu.2015.07.008

Warjanto, S. (2015). Pengembangan Media Pembelajaran Induksi Elektromagnetik. *Prosiding Seminar Nasional Fisika (E-Journal) SNF 2015*, *IV*.

Zweig, J., Irwin, C. W., Kook, J. F., & Cox, J. (2015). Data collection and use in early childhood education programs: Evidence from the Northeast Region. REL 2015-084. *Regional Educational Laboratory Northeast & Islands*, *April*.