PPSDP International Journal of Education
Volume 3 (2) (Special Issue) 22 October 2024, 367-381
2nd PPSDP International Conference on Educational Sciences (IConEds 2024)
E-ISSN 2829-5196, P-ISSN 2830-3229

The Use of Digital Smart Boards as a Means of Supporting TPACK-Based Interactive Learning

Isnaeni Machra Winayu[1]
[1]Universitas Bengkulu, Bengkulu, Indonesia

Corresponding author e-mail: isnaenimachrawinayu@gmail.com

Article History: Received on 18 August 2024, Revised on 19 October 2024, Published on 13 November 2024

Abstract: A new challenge in the world of education must be able to increase the attractiveness of learning by developing technology-based learning media with digital smart boards. This study aims to observe learning devices and models that use Smart Board Digital as a TPACK-based learning tool on learning quality. A type of research that uses data in the form of numbers to analyze and produce empirically measurable information. In this data collection study, the researcher used observation, questionnaire, and documentation techniques. The analysis techniques used are T-test and F-test. TPACK-based learning tools using Digital Smart Board have an effect on the quality of learning. There is a significant influence between the development of a learning model using TPACK-based Digital Smart Board on the quality of learning at SMPIT Mutiara Cendekia Lubuklinggau. Interactive Whiteboard revolutionizes the classroom experience by allowing teachers to display a variety of multimedia content such as videos, images, and interactive simulations directly on a large touch-sensitive screen that highly motivates students to learn. An innovative media that is able to attract students' attention to be actively involved in learning so that students' grades in learning can be better. One of them is the smart board learning media.

Keywords: Digital Smart Board, Interactive Learning, TPACK

A. Introduction

Advances in information technology and digitalization have entered various parts of life, including education (Handayani & Muliastrini, 2020). These advances have changed many aspects of life, including the way education is taught. According to Zazin & Zaim, (2019), one of the signs of the entry of education into the era of the industrial revolution 4.0 is the emergence of various educational models and digital learning media. Media can be used in studying both stationary and living things. The media that students use can help them understand the subject matter. Learning media is a tool that is intended to improve students' thoughts, feelings, attention, and desires so that the learning process can occur.

According to Wulandari et al., (2023) that learning media is a tool or intermediary that

helps teachers deliver material to students during the learning process. In learning, media can be in the form of living or stationary objects. Learning media is basically used to help students understand lessons. Media has a very important and strategic position to help achieve learning goals. In addition to clarifying the material, learning media can also increase desire, motivation and stimulation in learning activities. An innovative media that is able to attract students' attention to be actively involved in learning so that students' grades in learning can be better. One of them is the smart board learning media. Smart board media is a learning medium used to know and understand learning materials. According to Kamaladini et al., (2021) said that smart board media is a graphic media that can effectively display certain messages practically, consisting of boards, displays in the form of pictures, letters, and numbers that can be installed or removed.

Learning innovation is a very important aspect in the development of the education system in the digital era. In the midst of changes occurring in human civilization, education must also adapt itself through educational innovations designed to improve and solve problems in the world of education, especially in facing changes amidst the times. Computer-based or multimedia learning in the learning process can help students improve understanding learning concepts and motivation. The application of Internet of Things technology in the education sector can be done to improve student learning outcomes, improve the quality of teachers' learning methods and make activities easier, shorten time and lighten workload. To react fast to the evolving needs of social and economic life, several nations throughout the world have been devoting massive resources to include information and communication technology into education (Özdemir, 2010).

Good interactive media can make students have increased motivation to learn because the compatibility between media has a great impact on the success of an interactive media used. The better the learning media, the better the ability of students to receive learning (Harahap & Siregar, 2020). In the educational aspect, motivation is needed because it can be an enthusiasm for students to be able to participate in learning enthusiastically. The existence of learning motivation will guide students to be able to be themselves better or vice versa. According to the results of the research conducted Lomu & Widodo, (2018) said that motivation has a positive impact on students to improve learning achievement, where motivation arises from the encouragement that exists in each individual student consciously or unconsciously that is carried out to achieve the desired goals.

There are several international research results that state that making an interesting learning model with exposure to subject content will increase learning motivation (Ditta et al., 2020). This was also conveyed Aseery, (2024) that Teachers can use teaching, computer-based repetitive practices and applications, digital storytelling with animation, inclusive role modeling, reading with audio technology, and film

dialogue methods to increase motivation and engagement.

The characteristics of students who are familiar with technology and also the school's ability to buy technology equipment direct teachers and schools to immediately integrate ICT (information, communication, technology) in learning, or better yet, teachers can innovate learning using the TPACK (Technological Pedagocal Content Knowledge) approach. TPACK is the knowledge needed to integrate technology in learning. To realize the concept of TPACK-based learning and support the guided inquiry learning model, an innovative learning tool that is technology-based and interactive is needed. One of the learning tools is based on TPACK and supports learning. The digital learning program uses *a digital smart board* at SMPIT Mutiara Cendekia and has high achievement criteria for teachers and schools. TPACK is a type of knowledge that educators must have to be able to integrate technology appropriately in learning which has developed into a framework that can be used to assess teachers' abilities in relation to integrating technology in learning (Koehler et al., 2011).

Smart Board Digital is an interactive whiteboard that allows users to write, draw, and interact with digital content using a pen or finger (Syarifuddin & Utari, 2022). With this technology, teachers can create more engaging and dynamic presentations, as well as actively involve students in the learning process. *Digital Smart Board* uses touchscreen technology that connects with a computer or other device. According to Anastasopoulou et al., (2024) Interactive Whiteboards revolutionize the classroom experience by allowing teachers to display a wide variety of multimedia content such as videos, images, and interactive simulations directly on a large, touch-sensitive screen.

The learning challenge in the Society 5.0 Era is the adaptation of the use of Communication and Information Technology to provide billions of knowledge data to anyone who can access it. Technology, Communication and Information make people live in a world where knowledge can be accessed by anyone. In another study at a high school in Sydney that used quantitative and qualitative approaches to collect data on teachers' perceptions and students' perceptions of Chinese language learning utilizing PTI, it was concluded that: 1) interactivity was related to student engagement and motivation, 2) visual presentation was related to improved recall ability (Xu & Moloney, 2011).

The depth of analysis of subject matter is important to be determined by the teacher so that it requires content design-based learning using pedagogical methods and technology-based learning theories. This TPACK-based learning activity is so flexible because it can be done synchronously and asynchronously so that learning activities can be done anywhere, anytime, and with anything. Learning activities are very effective in improving learning achievement. The influence of learning tools using

TPACK-based Digital Smart Board and TPACK-based learning methods on learning quality.

Technology and pedagogical knowledge levels interact in unique ways. We find that defining instructors' technological Knowledge merely as their ability to use multiple technological tools makes a balanced and integrated TPACK profile unlikely. In contrast, teachers who can explicitly explain their grasp and use of pedagogical knowledge are more likely to display TPACK integration (Yeh et al., 2021).

Therefore, this study aims to observe learning devices and models that use Smart Board Digital as a TPACK-based learning tool on learning quality. The researcher hopes that the research will inspire teachers who will design learning to be able to implement learning tools and TPACK-based learning methods so that learning in the classroom is of higher quality.

B. Methods

The type of research used in this study is quantitative research. The research design chosen by the researcher is an experimental design or commonly called a semi-empirical design. According to Sugiyono, (2016) that experimental research can be interpreted as a research method used to find the influence of certain treatments on others under controlled conditions. Emphasis is placed on the relationship between variables, in which case the deliberate manipulation of variables is part of the empirical approach. The population of this study is all teachers of Digital Smart Board users at SMPIT Mutiara Cendekia Lubuklinggau as many as 20 people. In this data collection study, the researcher used observation, questionnaire, and documentation techniques. The data obtained was analyzed in the stages of information collection, editing, coding, tabulation, data analysis and drawing conclusions. In this study, the analysis techniques used are T-test and F-test. The device grid is arranged as follows:

Table 1. Definition and Indicator

No.	Definition	Indicator
1.	Development of TPACK-based learning tools (X1)	1. Connecting indicators of competency achievement per material. 2. Relevant learning objectives 3. Determine the right teaching method. 4. Formulate learning steps effectively. 5. Determine the learning resources that students can access easily. 6. Creating a technology-based assessment instrument. 7. Integrating learning planning with technology
2.	TPACK learning development (X2)	8. Choosing a learning model that students are interested in. 9. Determining the learning model according to

		the situation in the classroom 10. Communicate well with all parties (principals, guardians and students) through social media. 11. Test the learning model to be used first. 12. Analyze the shortcomings that occur from the learning model that has been implemented. 13. Able to manage classes. 14. Mastering the learning model that will be used to teach
3.	Quality of Learning using Smart Board Digital (Y)	15. Students enthusiastically participated in digital smart board learning from start to finish. 16. Students actively ask critical questions. 17. Students actively respond to statements given by teachers

C. Results and Discussion

Before testing a theory, the following should be evaluated first. This test is carried out to ensure that the data used is consistent with the distribution of the data. If the significance level is greater than 0.05, the data is generally distributed. Conversely, if the level value is less than 0.05, the data shows a difference. Based on data analysis using a computer program, namely SPSS 22. A significant value that shows the originality of the data that has been taken. A valid procedure can be used to divide if the data is the result of the Asymp coefficient. The Kolmogorov-Smirnov test output signal > 5% (0.05) of the alpha scale.

The linearity test in this study uses regression errors. It is said to be linear if the value of the sig on the deviation from linearity line has F with a significance of > of 0.05. If it is not significant, then the linearity test is continued using curve estimation by looking at the value of the gis on the significant linear curve line < 0.05.

Table 2. Teaching Quality (Y) to Teaching Tools (X1)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Teaching Quality (Y) * Teaching Tools (X1)	Between Groups	(Combined)	834.283	17	49.075	3.456	.017
		Linearity	699.882	1	699.882	49.283	.000
		Deviation from Linearity	134.402	16	8.400	.591	.838
	Within Groups		170.417	12	14.201		
	Total		1004.700	29			

From the output of the linear testing of the TPACK X1-based Learning Tool variable to the Learning Quality variable of Smart Board Digital Y, it shows that the significance value of linearity is 0.00 and the deviation from linearity is 0.838 ≥ 0.05, it can be concluded that the variables of the Learning Tool based on TPACK X1 are linear

with the Learning Quality variable using Smart Board Digital Y.

Table 3. Teaching Quality(Y) to Teaching Model (X2)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Teaching Quality(Y) * Teaching Model (X2)	Between Groups	(Combined)	817.117	15	54.474	4.066	.006
		Linearity	693.697	1	693.697	51.773	.000
		Deviation from Linearity	123.420	14	8.816	.658	.778
	Within Groups		187.583	14	13.399		
	Total		1004.700	29			

From the output of the linear testing of the TPACK X2-based Learning Model variable against the Digital Smart Board Learning Quality variable, it shows that the linear significance value is 0.00 and the deviation from linearity is 0.778 ≥ 0.05, so it can be concluded that the variable of the Learning Model based on TPACK X2 is linear with the Learning Quality variable using *the Digital Smart Board* (Y). The homogeneity test is intended to show that two or more groups of sample data from the population have similar differences. In regression analysis, the required analysis is such that the regression error for each group based on the bound variable has the same difference. From the results of SPSS 22 data analysis to test the homogeneity between the learning quality variable using the Digital Y Smart Board and the teaching tool variable (X1), the learning model (X2), it can be found that:

1. The TPACK X1-based learning tool has a P value of 0.415 > 0.05, so that homogeneous data samples are taken.
2. The TPACK X2-based learning model has a P-value of 0.257 > 0.05, so the data is taken from a homogeneous sample.

To find out the significance of the hypothesis, it is necessary to carry out a t-test (partial test). The t-test basically shows how far an independent variable is individually affected and explains the variation of the bound variable.

Table 4. X1 to Y Variable T-Test

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	26.247	6.631		3.958	.000
	Teaching Tools (X1)	.433	.192	.459	2.257	.032

a. Dependent Variable: Teaching Quality (Y)

From the Coefficient table above, a t-count of 2.257 was obtained. This means that the t-calculated value of 2.257 at the probability level (confidence) of 0.032 (97%) is obtained from the t-table for df = n-2 30-2 = 28 of 1.703. From the results of the calculation, it is known that the t-count value is 2.257 > t-table (2.257 > 1.703) and sig < 0.05 (0.032 < 0.05), this means that H0 is rejected and Ha1 is accepted. This meaning

implies that there is a significant influence between the development of TPACK-based learning tools on the quality of learning.

Table 5. X2 to Y Variable T-Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	26.247	6.631		3.958	.000
	Teaching model (X2)	.401	.190	.429	2.111	.044

a. Dependent Variable: Teaching Quality (Y)

From the Coefficient table above, a t-count of 2.111 was obtained at the sig level of 0.044. The t-table for df = n-2 = 30-2 = 22 = 8 is obtained for 1.703. From the results of the calculation, it is known that the t-calculated value is 2.111 > t table (2.111 > 1.717) and the sig < 0.05 (0.044 < 0.05), this means that H0 is rejected and Ha2 is accepted. This significance contains the implication that there is an influence of the development of a TPACK-based learning model on the quality of learning using the Digital Smart Board at SMPIT Mutiara Cendekia Lubuklinggau.

In addition to using the t test in this study, the F test will also be used. This test aims to find out whether the independent variables together have a significant effect on the dependent variables.

Table 6. F Test Variable X1, X2 to Y

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	743.073	2	371.536	38.343	.000[b]
	Residual	261.627	27	9.690		
	Total	1004.700	29			

a. Dependent Variable: Teaching Quality (Y)
b. Predictors: (Constant), Teaching Model (X2), Teaching Tools (X1)

Based on the data from the test results of the F-test using the SPSS 22.0 program, F is calculated as 38.343 with a significance of 0.000 while the F table for the value of n = 30, df1 = K-1 = 3-1 = 2, and df2 = n-k-1 = 30-3-1 = 26 so that the F table is 3.37. So that F is calculated > Ftable (38.343 > 3.370) and the significance value is 0.00 < 0.05. This shows that the calculated F value obtained is significant so that the working hypothesis tested in this study is that there is a positive and significant influence between the variables of the learning tool X1, the X2 learning model based on TPACK X3 together on the quality of learning using the Digital Smart Board at SMPIT Mutiara Cendekia Lubuklinggau.

From the regression results, a correlation coefficient / R value of 0.835 was obtained

so that it can be concluded that there is a strong influence between the variables of the learning device X1, the learning model X2 together on the quality of learning using digital smart boards. Meanwhile, the determination coefficient (R2) of 0.831 means that the contribution of the X1 learning tool variable, the X2 learning model together to the learning quality of the digital smart board is 83%, while the remaining 17% is due to other reasons outside the variables studied. This indicates that teachers need to integrate learning tools, TPACK-based learning models to answer the demands of interactive learning. Because it has been proven to improve the quality of learning at SMPIT Mutiara Cendekia Lubuklinggau. In addition, this also indicates that teachers must continue to develop themselves to change, especially in the challenges of the industrial revolution 4.0. Teachers who are responsive and active will be able to adapt quickly to ensure that the quality of learning is maintained to realize the ideals of national education. Based on the results of the study, there are several findings that affect the quality of learning, including:

TPACK-based teacher competency development using Digital Smart Board affects the quality of learning

Learning orientation in the current modern era to realize students who have quality and reliable competencies must begin with producing quality teachers. A quality teacher is a teacher who has four standards of teacher competence. Based on Government Regulation (PP) Number 19 of 2005 concerning National Education Standards, it is stated that there are 4 teacher abilities, namely Pedagogic Competence, Personality Competence, Professional Competence, and Social Competence.

To develop the four teacher competencies, it can be done by developing TPACK-based teacher competencies. A tough challenge faced by the world of education in Indonesia in the global complex is the ability of teachers to design teacher competency development plans called TPACK or *Technological Pedagogical Content Knowledge*. TPACK is a comprehensive integration of knowledge and skills in terms of materials, and pedagogy integrated in technological development.

Professional teachers must have adequate TPACK competence, because TPACK is in the realm of four main competencies of a teacher which include pedagogical competence, competence and personality, social competence and professional competence. According to Schmid et al., (2020) in his research, he said that the integration of TPACK is able to increase self-confidence as well as improving the competence of teachers' content, pedagogy, and technology in designing learning. Therefore, the pattern of teacher competency development with TPACK is an appropriate way to ensure the implementation of learning in accordance with the demands and changes that occur. Before teacher competency development is carried out, the condition of teachers' TPACK abilities must be analyzed which will be the basis for policy formulation. TPACK is considered a framework that can provide a

new direction for teachers to solve problems on how to integrate ICT into classroom learning.

Teachers in the digital era must be able to choose, develop and utilize various types of learning media that can attract the attention of digital native students, creativity in designing is a must-have for teachers (Sarah et al., 2021). The learning media created must be multimodal or present in various formats. Teachers must be able to create visual media in the form of diagrams or infograms, audio media such as podcasts or audio books, or audio-visual media such as learning videos and the use of various learning applications as media (Akar, 2020).

Examination of the various technological tools Smart Board Digital in light of their contribution to the research-proven dimensions of outstanding teaching might enhance the pedagogical contribution of technological developments to teaching (Davidovitch & Yavich, 2017).

TPACK-based learning tools using Digital Smart Boards have an effect on the quality of learning

The significant influence between the development of TPACK-based learning tools on the quality of learning at SMPIT Mutiara Cendekia Lubuklinggau. So that the better teachers have an understanding of TPACK-based learning tools, the better they will improve the quality of their learning. So far, many teachers consider that learning tools are only limited to formalities as administrative requirements in teaching.

According to Wulandari et al., (2023) that teachers have not understood and are not aware of how necessary and important the implementation of education is in the implementation and development of education. Because the learning process carried out by teachers will run well if supported by good leadership. Teachers are not only teachers but also managers in the field of education. Teachers are obliged to work administratively regularly, everything related to the learning process must be managed properly.

The teacher's ability to create learning resources will affect the success of curriculum implementation in the classroom (Wuwur, 2023). The preparation of learning tool standards must pay attention to the components of knowledge, ability, and attitude (Kurnianto & Sarwono, 2023). Learning tools have a strategic role in the learning process by functioning as guidelines, benchmarking activities, and evaluation of learning, as well as improving the professionalism of a teacher.

Learning tools that meet the requirements of high validity, practicality, and effectiveness will be of high quality. The creation of learning tools will be optimal if there is a consistent relationship between each component of the resulting learning

tool and the characteristics of the model used. Innovative learning tools that can be applied in the classroom as needed so that they are not monotonous and lack of impact or maximum results in learning, so there is a need for innovation in the form of teachers' willingness (Hikmah et al., 2023).

Designing the learning process by integrating ICT (Information and Communication Technology) makes a significant contribution to the level of practice pedagogies to students. Teachers are required to have IT literacy skills in the science learning process using various learning methods and approaches. The success of 21st century learning is related to understanding concepts, how teachers teach and the use of information technology synergies. In this case, TPACK is believed to be suitable for application to the learning process in the 21st century, TPACK can help increase students' creativity and activity in the learning process.

In this period of online literacy, a teacher is needed who is able to master or at least be able to use technology that supports the guidance and literacy process. In addition to the use of technology, there are also important implications that need to be considered in the literary process, the practice of video teaching, and the generalization understanding of the subjects to be taught. So, a way is needed to uncover these 3 things, namely through the TPACK approach. Baram and Uygun (2016) said that TPACK is the framework a teacher needs to improve the practice of pedagogical and abstract understanding along with technological literature. In TPACK, teaching tools are packaged with literacy models according to their characteristics and integrated with technology. The literacy model is an abstract framework that describes a systematic approach to organizing educational activities in order to achieve literacy goals. Therefore, in order to improve and improve teachers' understanding of the general concept of TPACK-based literacy, learning is designed so that teachers can develop learning tools in the form of Learning Implementation Plans, Student Worksheets, Student Teaching Materials, and TPACK-based online Evaluation tools.

According to Williams & Beam, (2019) One way to support the development of teachers' ability to integrate technology into tutoring and reading and writing processes is to use the TPACK approach, which will help create a framework for integrating content or material knowledge, capacity for teachers' pedagogical and technological skills. In addition, TPACK can also encourage researchers to become qualified, encouraging researchers to share and research more guidelines and reading processes to create a more efficient and innovative reading process.

TPACK emphasizes the relationship between technology, classroom environment, and pedagogical methods that interact to create ICT-based literature. In the TPACK scheme there is a relationship between constitutive factors. The selection of ICT devices in TPACK-based literacy devices must be adjusted to literacy subjects and teaching facilities, so that students gain more meaningful experiences, so that they are

suitable for solving computing problems. Using literacy media supported by animated videotapes to help students understand the material delivered by the teacher.

TPACK-based learning model affects learning quality

There is a significant influence between the development of a learning model using TPACK-based Digital Smart Board on the quality of learning at SMPIT Mutiara Cendekia Lubuklinggau. So that the better teachers have an understanding of the learning model using the TPACK-based Digital Smart Board, the more they will improve the quality of their learning. Because some teachers still like the Teacher center learning model which is considered an effective way to channel knowledge. But not a few end up with monotonous and boring learning for students (Mora, 2011). Teachers can no longer rely on the old methods but on student center learning models where teachers act as mediators and facilitators remotely. Therefore, with the development of this TPACK-based learning model, teachers will learn how to use informatics media to teach and change teachers' old paradigms related to conventional learning. The better teachers understand and apply the TPACK-based learning model, the more they will improve the quality of their learning. Quality learning can be achieved, one of which is by applying the TPACK-based learning method to students, especially coupled with the use of Smart Board Digital learning facilities.

Learning media is everything that is used to help convey things related to the teaching and learning process (Marpanaji et al., 2018). Because with learning media, it is hoped that the knowledge taught will reach people who follow the teaching and learning process, then it can be understood and understood about this knowledge. Learning media is also an instructional component consisting of messages, people, and equipment or objects. Along with the development of the times, knowledge, and technology, therefore learning media has also experienced development and progress. This says that there are many types and variations of learning media along with the development of knowledge and technology.

The use of Digital Smart Boards by teachers requires the support of various things, namely; First, teachers are able to create and/or utilize the best content (whether text, graphics, visuals, animations, or movies), and this content can be obtained from various sources (the internet), second, teachers are able to develop various effective and fun classroom interaction models by paying attention to various aspects such as learning styles, multiple intelligence, interests and attention of students, third, teachers are able to master technical skills on how to operate Smart Board Digital equipment optimally take advantage of all the advantages that exist in the tool.

The use of Digital Smart Boards by teachers requires systematic efforts and the

strategies taken by teachers must be well designed. From the beginning of learning planning, teachers must prepare materials and activities that will be carried out. Various studies prove that at first teachers need longer to prepare learning using the Digital Smart Board, but then its use actually shortens the time to prepare for learning with facilities to store files and share with fellow teachers (Purwanto, 2013). When teachers are more familiar and comfortable with Digital Smart Boards, they will collaborate more and various resources with more expert colleagues online. Even the busiest teachers can prepare for the use of Smart Digital Boards well in less time (Koh et al., 2015).

Teachers' perception of the use of Digital Smart Board that teachers consider the tool currently used to be very helpful in the learning process, increase students' enthusiasm in learning, and they feel comfortable. The model of using the Digital Smart Board is considered to be supported by learning theory, which results in changes in the learning process, and changes in its users, namely teachers and students. The use of Digital Smart Boards is changing the way teachers prepare for learning and requires new skills using content, pedagogy and technology

D. Conclusions

Based on research on the use of digital smart boards as a means of supporting TPACK-based interactive learning, it can be concluded that developing TPACK-based learning tools using Digital Smart Boards has an effect on the quality of learning carried out at SMPIT Mutiara Cendekia, meaning that the better teachers have an understanding of learning tools and learning models based on TPACK, the better the quality of learning will be improved which he did. The use of Digital Smart Boards by teachers requires the support of various things, namely; First, teachers are able to create and/or utilize the best content (whether text, graphics, visuals, animations, or movies), and this content can be obtained from various sources (the internet), second, teachers are able to develop various effective and fun classroom interaction models by paying attention to various aspects such as learning styles, multiple intelligence, interests and attention of students, third, teachers are able to master technical skills on how to operate Smart Board Digital equipment optimally take advantage of all the advantages that exist in the tool.

E. Acknowledgement

The author would like to thank those who have helped in completing this study, namely the respondents who have taken their time in filling out the questionnaire so that the study carried out can be completed.

References

Akar, H. (2020). The effect of smart board use on academic achievement: A meta-analytical and thematic study. *International Journal of Education in Mathematics, Science and Technology*, *8*(3), 261–273. https://doi.org/10.46328/ijemst.v8i3.908

Anastasopoulou, E., Katsonis, N., Stavrogiannopoulou, M., Travlou, C., Mitroyanni, E., & Tsogka, D. (2024). The Role of ICT in Enhancing Modern Teaching Practices in Elementary Schools. *Technium Social Sciences Journal*, *60*(1), 38–45. https://doi.org/10.47577/tssj.v60i1.11440

Aseery, A. (2024). Enhancing learners' motivation and engagement in religious education classes at elementary levels. *British Journal of Religious Education*, *46*(1), 43–58. https://doi.org/10.1080/01416200.2023.2256487

Davidovitch, N., & Yavich, R. (2017). The Effect of Smart Boards on the Cognition and Motivation of Students. *Higher Education Studies*, *7*(1), 60–68. https://files.eric.ed.gov/fulltext/EJ1135741.pdf

Ditta, A. S., Strickland-Hughes, C. M., Cheung, C., & Wu, R. (2020). Exposure to information increases motivation to learn more. *Learning and Motivation*, *72*. https://doi.org/10.1016/j.lmot.2020.101668

Handayani, N. N. L., & Muliastrini, N. K. E. (2020). Disruptive era learning towards the era of society 5.0 (review of basic education perspective). *Prosiding Seminar Nasional IAHN-TP Palangka Raya*, *1*, 1–14.

Harahap, L. K., & Siregar, A. D. (2020). Development of interactive learning media based on Adobe Flash CS6 to improve motivation and learning outcomes in chemical equilibrium material. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *10*(1), 1910–1924. https://doi.org/10.26740/jpps.v10n1.p1910-1924

Hikmah, N., Sarjana, K., Wahyu Triutami, T., Lu, U., & Kurniawan, E. (2023). Training in making TPACK-based learning devices for teachers at Al-Aziziyah Gunungsari Madrasah. *Rengganis Jurnal Pengabdian Masyarakat*, *3*, 239. https://mathjournal.unram.ac.id/index.php/Rengganis/index

Kamaladini, K., Abd Gani, A., & Sari, N. (2021). Development of Smart Educational Board Media in Increasing Elementary School Students' Learning Motivation. *Seminar Nasional Paedagoria*, *1*, 93–100. https://journal.ummat.ac.id/index.php/fkip/article/view/5693

Koehler, M. J., Mishra, P., Bouck, E. C., DeSchryver, M., Kereluik, K., Shin, T. S., & Wolf, L. G. (2011). Deep-play: Developing TPACK for 21st century teachers. *International Journal of Learning Technology*, *6*(2), 146–163. https://doi.org/10.1504/IJLT.2011.042646

Koh, J. H. L., Chai, C. S., Benjamin, W., & Hong, H.-Y. (2015). Technological pedagogical content knowledge (TPACK) and design thinking: A framework to support ICT lesson design for 21st century learning. *The Asia-Pacific Education Researcher*, *24*, 535–543. https://eric.ed.gov/?id=EJ1180737

Kurnianto, B., & Sarwono, R. (2023). Development of TPACK-based learning tools to improve students' learning activities and problem-solving abilities. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *13*(3), 210–221. https://doi.org/10.24246/j.js.2023.v13.i3.p210-221

Lomu, L., & Widodo, S. A. (2018). *The influence of learning motivation and learning discipline on students' mathematics learning achievement*.

Marpanaji, E., Mahali, M. I., & Putra, R. A. S. (2018). Survey on how to select and develop learning media conducted by teacher professional education participants. *Journal of Physics: Conference Series*, *1140*(1), 012014. https://doi.org/10.1088/1742-6596/1140/1/012014

Mora, R. (2011). "School is so boring": High-stakes testing and boredom at an urban middle school. *Penn GSE Perspectives on Urban Education*, *9*(1). https://files.eric.ed.gov/fulltext/EJ957120.pdf

Özdemir, S. (2010). 'To err is human, but to persist is diabolical': Loss of organizational memory and e-learning projects. *Computers & Education*, *55*(1), 101–108. https://doi.org/10.1016/j.compedu.2009.12.007

Purwanto. (2013). *The Use of Interactive Whiteboard in Classroom*.

Sarah, S., Si, S. P., Fuadi, T. M., Hadiati, S., Aswita, D., & Saputra, S. (2021). *Becoming a Professional Educator in the Era of Industrial Revolution 4.0*. K-Media.

Schmid, M., Brianza, E., & Petko, D. (2020). Developing a short assessment instrument for Technological Pedagogical Content Knowledge (TPACK. xs) and comparing the factor structure of an integrative and a transformative model. *Computers & Education*, *157*, 103967. https://doi.org/10.1016/j.compedu.2020.103967

Sugiyono. (2016). *Qualitative Quantitative Research Methods and R&D*. Alfabeta.

Syarifuddin, M. P., & Utari, E. D. (2022). *Learning media (From conventional to digital)*. Bening Media Publishing.

Williams, C., & Beam, S. (2019). Technology and writing: Review of research. *Computers & Education*, *128*, 227–242. https://doi.org/10.1016/j.compedu.2018.09.024

Wulandari, A. P., Salsabila, A. A., Cahyani, K., Nurazizah, T. S., & Ulfiah, Z. (2023). The importance of learning media in the teaching and learning process. *Journal on Education*, *5*(2), 3928–3936. https://doi.org/10.31004/joe.v5i2.1074

Wuwur, E. S. P. O. (2023). Problems of implementing the independent curriculum in elementary schools. *SOKO GURU: Jurnal Ilmu Pendidikan*, *3*(1), 1–9. https://doi.org/10.55606/sokoguru.v3i1.1417

Xu, H. L., & Moloney, R. (2011). Perceptions of interactive whiteboard pedagogy in the teaching of Chinese language. *Australasian Journal of Educational Technology*, *27*(2). https://doi.org/10.14742/ajet.972

Yeh, Y.-F., Chan, K. K. H., & Hsu, Y.-S. (2021). Toward a framework that connects individual TPACK and collective TPACK: A systematic review of TPACK studies investigating teacher collaborative discourse in the learning by design process. *Computers & Education*, *171*, 104238. https://scholar.lib.ntnu.edu.tw/en/publications/toward-a-framework-that-connects-individual-tpack-and-collective--2

Zazin, N., & Zaim, M. (2019). Islamic Religious Learning Media Based on Social Media for Generation Z. *Proceeding Antasari International Conference*, *1*(1).