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TPACK Based on PjBL Preservice Teachers's Skill in Developing Digital Economics Teaching Material

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Abstrak

Penelitian ini dilatarbelakangi oleh rendahnya keterampilan guru dalam menyusun perangkat pembelajaran digital, serta adanya serta ketidakmampuan guru menyiapkan materi pembelajaran yang sesuai dengan kebutuhan siswa. Selain itu, pelatihan-pelatihan yang ada saat ini masih dilakukan secara terpisah dan belum komprehensif dalam mengintegrasikan teknologi, pedagogi, dan konten secara menyeluruh. Tujuan penelitian ini adalah menguji efektivitas metode project based learning dalam meningkatkan keterampilan mengembangkan perangkat pembelajaran digital. Penelitian ini dilakukan dengan pendekatan kuantitatif, metode experimen dengan desain quasi experiment nonequivalent control group design. Dengan teknik simple ramdom sampling, diperoleh 90 guru dalam jabatan. Pengumpulan data dengan observasi dan test. Instrumen adalah test dan non test. Teknik analisis data digunakan one way anova dengan menggunakan uji F dan Pos Hoc Tukey. Hasil penelitian ini menyatakan dengan metode pembelajaran project terjadi peningkatan terutama keterampilan mengembangkan syntax pembelajaran pada modul ajar, memproduksi media digital, menyusun bahan ajar digital dan mengembangkan asesment. Kesimpulan menyatakan project based learning dapat meningkatkan keterampilan mengembangkan perangkat pembelajaran digital dalam pembelajaran ekonomi. Implikasi dari penelitian ini bahwa project based learning baik di gunakan untuk pembelajaran yang bertujuan pengembangan produk dan perbaikan kualitas pembelajaran yang berkelanjutan.

Kata Kunci: *Keterampilan, Pembelajaran, Project, Perangkat, Ekonomi.*

Abstract

This research is motivated by the low skills of teachers in developing digital learning tools, as well as the need for teachers to prepare learning materials that suit the needs of students. In addition, current trainings are still conducted separately and need to be more comprehensive in integrating technology, pedagogy, and content. This study aims to examine the effectiveness of the project-based learning method in improving the skills of developing digital learning tools. This research was conducted using a quantitative and experimental method with a quasi-experiment nonequivalent control group design. With a simple random sampling technique, 90 in-service teachers were obtained. Data collection by observation and test. Instruments are tests and non-tests. Data analysis techniques used one-way anova using the F test and Tukey's Post Hoc. The results of this study state that with the project learning method, there is an increase, especially in the skills of developing learning syntax in teaching modules, producing digital media, compiling digital teaching materials, and developing assessments. The conclusion states that project-based learning can improve the skills of creating digital learning tools in learning economics. This research implies that project-based learning is good for learning aimed at product development and continuous improvement of learning quality.

Keywords: Skill, Learning, Project, Material, Economics.

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1. INTRODUCTION

In the development of globalization with the massive use of technology, teachers need to have the skills to use technology for learning. Mastering this technology is beneficial for both teachers and students. For teachers, the use of technology can increase the efficiency of the teaching and learning process, increase student engagement access wider learning resources, develop century-old skills to 21 and adaptive to emergency situations. A learning environment that uses technology can improve student-centered learning experiences. The use of technology can also increase creative class and awareness of social culture (Al Njadat

et al., 2021; Barai & Saha, 2022; Bond & Bedenlier, 2019; Crompton et al., 2021; Dr. Lohans Kumar Kalyani, 2024; Dwarakanath et al., 2021; Gopo, 2022; Lewis, 2009; Li et al., 2022; Persichitte, 2016; Ramaila & Molwele, 2022; Yadav, 2023; Yang et al., 2024) One important factor in teacher quality is the teacher's skill in preparing learning material. Learning material consist of lesson plans, textbooks, lear media and evaluation. The function of learning material function is increase the effectiveness of learning (Adalikwu & Iorkpilgh, 2013; Hutabarat, 2023). Teachers' inability to prepare learning material results in unstructured and disorganized learning, which confuses students and hinders the achievement of learning objectives. In addition, the inability to prepare learning material causes incompatibility with student needs, low motivation, lack of objective assessment, and unable to develop students' creativity. In reality, teachers do not prepare lesson plans independently. Teachers tend to take shortcuts by not making preparations when going to do learning. Teachers are also difficult in determining the allocation of learning time, formulating objectives, indicators of competency achievement, depth of material, determining learning methods in lesson plans. Teachers' teaching experience, differences in the characteristics of students and actualizing their potential, the limited facilities available at school, and the lack of motivation and understanding of teachers in assessment. In addition, the ability of teachers to use technology for learning effectiveness is still low even though technology in recent decades has significantly changed the model and method of learning (Harmawati et al., 2024; Permana et al., 2021). The competence of teachers, the use of technology is also an effort to increase the effectiveness and efficiency of the learning process. Teachers difficult to choose and utilize media, learning resources, and methods that can support character-based learning objectives (Java, 2022; Kholifaturrohmah & Mulasiwi, 2021). Teachers are more accustomed to assessments that only contain the cognitive domain and rarely develop alternative assessments that include affective assessments

Improving learning material skills with project-based learning models is based on the theory of social constructivism (Akpan et al., 2020; Trif, 2015). According to constructivism theory, the most effective learning occurs when students are given tasks that are slightly outside their ZPD, which can then be completed with help from adults or more experienced peers, emphasizing that learning does not only occur within the mind of the individual, but also in a social context with (Akpan et al., 2020; Trif, 2015). One of the learning methods that emphasizes collaborative, active and involved learners in learning was Project Based Learning (PjBL). Project-based learning is a student-centred form of instruction which is based on three constructivist principles; (1) learning is context-specific, (2) learners are involved actively in the learning process (3) they achieve their goals through social interactions and the sharing of knowledge and understanding constructive investigations, (4) autonomy and (5) realism, with the importance of student collaboration, reflection, redrafting, and presentations emphasised in other publications. Project-Based Learning (PjBL) has a positive influence on the competencies of teachers. PjBL enhances deep collaborative multidisciplinary learning and engages learners in authentic practices, which are considered core practices of PjBL and also affect power relations among some students (Crossouard, 2014; Kwon et al., 2016; Lillo, 2023).

Learners can plan, design, and reflect on their learning through projects and communicate reports learners can plan, design, and reflect on their learning through projects and communicate reports to teachers and industry teaching staff. However, besides the advantages of project-based learning in improving teacher skills, there are weaknesses of project-based learning in improving skills, including the need for more time in project implementation, subjective evaluation, project management readiness, and limited resources. In addition to having pedagogical knowledge, preservice teacher need to have the ability to integrate pedagogical, content and technological knowledge in carrying out learning or

TPACK skills. Thus, the skills and learning tools produced are oriented towards TPACK learning. In its implementation, TPACK requires digital learning tools, such as digital teaching modules, ICT-based digital learning media, digital teaching materials and digital learning evaluation. To improve skills in producing learning devices, it is necessary to apply appropriate learning strategies. Previous research stated that increasing teachers' skills in creating learning meterial was carried out by training in creating digital teaching modules (Jamhari et al., 2023; Made & Yusana, 2023) training in preparing learning syntax with SPIES; increasing teachers' skills in developing digital learning media was carried out by training, getting schools used to using LMS (learning management system), provides guidebooks for preparing teaching media and the development of teaching resources is carried out through training, providing digital pedagogy facilities for teachers and students and digital system support for institutional administration (Adu & Zondo, 2024; Aluko & Ooko, 2022; Cabellos et al., 2024; Hatos & Clipa, 2022; Mo, 2024; Pimdee et al., 2024)**.** In previous research, improving skills was carried out separately in each learning content, for example, focusing on skills in making teaching modules only or on learning media only.

In this research, skills development was carried out comprehensively within a certain period of time relatively long. This is based on learning process standards, that learning is a process that occurs in connection with planning, implementation and assessment (Adu & Zondo, 2024; Anak et al., n.d.; Cabellos et al., 2024; Jamhari et al., 2023; Made & Yusana, 2023; Pimdee et al., 2024; Ramatni et al., 2023)**.** Therefore, treatment is carried out to improve the skills in compiling digital teaching modules, ICT learning media, digital textbooks and digital learning assessments. The novelty of this research is, apart from integrating all stages of the standard learning content process. This research makes efforts to improve skills using the Project Based Learning method which is carried out over a longer period of time than previous research, and measures the level of effectiveness through comparison with groups that do not use the Project Based Learning method in an experimental design. The use of this research method is expected to produce more measurable effectiveness. Project based learning was chosen because many participants are actively involved in the learning process and provide learning experiences in the real world. So far, teacher made the insruction and assignment based on unreal situation, that often didn't reflect the real world.

2. METHODS

This research carried out a quantitative approach, an experimental method with a quasi-experiment nonequivalent control group design. Quasi experiment was used to investigate the relationship between the intervention and the impact on learning outcomes. In this case the experimental class received treatment (X) while the control class received without treatment. The object of this research was the level of skills in developing economic learning material which include (1) theme 1, skills in compiling teaching modules (2) theme 2, skills in producing digital learning media (3) theme 3, skills in making digital teaching materials and (4) theme 4, compiling learning evaluation instruments. While the research subjects were college students who are perspective teachers at the final level. Data collection was carried out by observation, test and non test. The instruments used are test and non-test. The instruments used are tests and non-tests. The test was used in the pretest and posttest to determine understanding of the concept of digital learning tools in economics learning with a score range of 0-100, while the non-test was in the form of an authentic assessment to assess processes and products while working on project assignments. Authentic assessment includes individual and group assessments which was converted on a scale of 1-100. This type of quasi-experimental design was carried out using procedures (1) Students were divided into

two groups, namely the experimental group and the control group each 45 students (2) testing pre-test questions to students in treatment classes and also control class (3) the results of the pre-test for the treatment class and control class were tested using a different test, namely the t-test. to determine whether there are any significant differences. If both groups are homogeneous, then the experiment can continue. Experimental group students were given treatment, using the project based learning method for 8 meetings, while the control class were not given treatment or learned using the lecture and question and answer method (4) in each meeting, next step is to carry out a post test. The results of the post test for the treatment class and control class were tested again difference test by one way ANOVA to determine whether there was a significant difference. The implementation of this research was carried out for 10 meetings, each meeting was 3 credits = 150 minutes. The instruments used were 3 pretest instrument packages and 3 post-test instrument packages for the control class, and 4 instrument packages consisting of teaching module product assessment instruments, digital learning media, teaching materials and digital evaluation instruments.

The population was students of the economic education study program who have passed TPACK-oriented courses, namely digital economic learning and ICT literacy and economic learning media, we called them preservice teacher (PST's). The sample in this group was 90 Economics PST's. They were divided into two groups of 45 PST's each. The data that has been obtained was then analyzed using descriptive statistics and inferential. The data analysis technique used was one way ANOVA, because it only has one independent variable (TPACK based PjBL method) and one dependent variable (PST's Skill). To carry out the Anova test, according to, several assumptions must be met, namely (1) the sample comes from an independent group (2) The variance between groups must be homogeneous 3) The data is normally distributed**.** The validity test carried out was the Pearson test and the reliability test with Cronbach's alpha. The validity test was carried out using the Pearson test which states that if r count > r table, then the item was said to be valid. Here, the r table at df 43 and $\alpha = 0.05$ was 0.2159 and all items have a calculated r > 0.2159. Thus, all items were valid. Reliability was tested with Cronbach's alpha. Items are reliable if Cronbach's alpha > 0.05. From the calculation results, Cron Bach's alpha is 0.847. So all the items used were valid and reliable. The assumptions in One Way ANOVA analysis were the prerequisites for normality and homogeneity. The results of the normality test using the Levene test using SPSS 26 showed that the data on skills for preparing economic learning tools was normally distributed. So the One Way ANOVA analysis can be continued. The next test was the homogeneity test. The test was carried out using One-Sample Kosmogorov Smirnov. The homogeneity test results stated that the data obtained was homogeneous. Based on this, data processing using one way anova can be carried out.

3. RESULTS AND DISCUSSION

Result

The results and discussion in this research include a discussion of the research questions asked. In this case, there were two research questions which are discussed both descriptively and in verification statistics by processing the data using ANOVA. The results of this study showed that in general, the implementation of TPACK based on PJBL to improve the skills of preparing learning tools as seen from the gain before and after the use of project-based learning methods, as well as from the comparison of class skills with project-based learning methods and with conventional (question and answer learning methods. In addition, the results of this study also showed changes in skills in each aspect. The significance of skill differences is based on the results of analysis using One Way ANOVA. The results of the ANOVA calculation are presented in Table 1.

Table 1. Result Of One Way ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1532.872	3	510.957	3.306	0.021
Within Groups	29057.183	188	154.559		
Total	30590.055	191			

Source: Data Processing 2023

Based on the results of data processing using one way ANOVA, the results showed that there were significant differences in skills in improving learning material, namely skills in improving digital teaching modules, producing digital learning media, digital teaching materials and digital evaluation tools. The results showed that there was an increase in the skills of developing learning tools both with conventional methods and with project-based learning methods. In this case, the increase in skills at the experimental group or those trained with project-based learning is higher than with conventional methods, in all types of learning devices. To find out which learning material improves the most with the Project based learning method, a Post Hoc test was carried out. The results of the pos hoc calculation are presented in Table 2.

Table 2. Pos Hoc Test Result

Learning Instruction	N	Subset for alpha = 0.05		
		1	2	3
4.00	48	25.8219		
1.00	48		34.2656	
2.00	48		35.0658	
3.00	48			39.6929

Based on Post Hoc test results, test scores were divided into 3 subsets. Subset 1 was the lowest subset, namely the score for preparing the learning evaluation. Subset 2 was the value of skills in compiling teaching modules and teaching materials and subset 3 was the highest value group was skill in preparing of digital media.

Discussions

The advantage of this research is that it explains the significance of the differences between the experimental group and the control group in each skill, including indicators of skills in creating teaching modules, ICT-based learning media, digital teaching materials and compiling digital assessments. The skill of compiling learning material is the most important skill in carrying out the profession as a teacher. This research also reveals what skills have the greatest improvement with the project based learning method. An explanation of the skills measurement results is in this section. Teaching modules are lesson plans for learning in the independent curriculum. Modules can be interpreted as subject matter that is compiled and presented in writing in such a way that the reader is expected to absorb the material themselves. In other words the module is a learning material where the reader can learn independently (Matanluk et al., 2013; Supriadi et al., 2008) Modules in online learning must make students more independent, developed seeks to maximise the use of technology (Msila & Setlhako, 2013; Panzer & Gronau, 2024)**.** A good teaching module is shown by being correct in compiling the statement of purpose, consistent among the elements of the teaching module, designing learning from simple to complex, and designing learning steps according to the rules for preparing syntax (www.kurikulum.kemdikbud.go.id). This research

implemented four indicators to measure skill in developing teaching module, which skill in (1) developing learning objectives (2) designing triggering sentences (3) Designing learning steps according to the correct learning syntax (4) Able to compile teaching modules that are consistent between objectives and other teaching module elements. The effectiveness of the project-based learning method in improving teaching module preparation skills can be seen from the significance of the gain of the control group and the experimental group, where the experimental group score is higher than the control group score.

Based on result of treatment, four indicators measured, the skill score for compiling learning steps in accordance with the correct syntax has a relatively high value compared to other skill indicators. Meanwhile, skills in preparing teaching modules that are in accordance with other teaching module elements are relatively low. This is shown by the gradation of material that has not been tiered from easy to difficult material and the order of the material does not follow the order of the taxonomy level. Modules' focus on active learning is based on a deep understanding of how students learn most effectively. Cooperative learning, writing across the curriculum, and guided discovery-based learning have all been shown to increase higher-level thinking and problem solving as well as retention of material. The goal of the modules is to provide resources to instructors that will allow them to transform their classrooms into active, student-centered learning environments (Chantarasombat & Kaen, 2020; Wilkerson, 2014)**.**

Project-based learning mainly improves skills in formulating trigger sentences and consistency between elements in the module. This makes it easier for students to learn independently, be interested in learning and be creative (Ayu et al., 2021; Msila & Setlhako, 2013; Panzer & Gronau, 2024; Wilkerson, 2014). In the control group, the ability to compile modules was low, resulting in students being confused, unable to follow the learning process, not interested in learning and unable to learn independently. The low level of online teaching modules can also reduce student engagement, satisfaction with learning and student learning retention. This skill improvement can be caused by deep student collaboration and real practice done by learners while working on projects. Projects share a set of characteristics: (1) authenticity: learning involves a real problem and an effective solution has to be found; (2) complexity: the problems are complex tasks, and solution requires a significant investment of time; (3) centrality: the activity is significant and central to the curriculum of students, it is not complementary or a peripheral activity; (4) construction research: a goal-directed process, which involves asking students to discuss and build their knowledge and solve problems and PST's because learners correct each other's work continuously (García, 2016; Wicaksono, 2023).

The ability to prepare an online teaching module can be increased through the Training Project Based Learning (Ho et al., 2023; Setiawan et al., 2021). Resource individuals were required to establish a time management flow, offer direction, and provide breaks for activities in order to maintain participants' intense and concentrated attention throughout the program. The presenters' inventiveness was required to create a visually Appealing and High-Caliber Presentation. Module compilation capabilities can also increase by the project based learning method with the Tessmer's Development Model with two Main Stages, Namely the Preliminary Stage Which Consists of the Analysis and Design Stages, The Formative Evolution Stage Which Consists of Self Evaluation, and Export Review (Setiawan et al., 2021; Wati & Apriani, 2021)**.** The skill of producing digital learning media is one of the skills of a 21st century teacher. Teachers' ability to engage students in the learning activities is critical to the success of project-based learning implementation. Digital learning media is a messenger technology that can be used for learning purposes and is a physical an communication tool intended to convey learning to improve the quality of learning. The internet world has become a classroom in the current digital era (Chen, 2024;

Harmawati et al., 2024; Msila & Setlhako, 2013). Teachers and students alike need to be capable of critical thinking, creativity, innovation, and technology-based problem solving in order to meet the challenges of the twenty-first century. Digital literacy is necessary to use digital technologies in educational settings. In order to improve the efficacy and efficiency of the learning process as well as students' adaption, it is imperative that students' reading levels and digital competence (Gray & Diloreto, 2016; Harmawati et al., 2024). Digital media can enrich students' learning experience exciting, interactive and educational experience, combining free-time entertainment and education (Degner et al., 2022; Manakane & Rakuasa, 2023; Ramatni et al., 2023). In this research, there are four indicators used in this research (1) adapting media to learning objectives (2) producing attractive media designs (3) using digital devices (4) integrating text, images, audio, video, and other multimedia elements to enhance learners' understanding.

The skill of producing digital learning media from the four skill indicators used, there is a significant difference between the control class and the experimental class. Where the experimental class score is greater than the control class. This means that the project-based learning model can improve the skills of producing digital learning media. Of the five indicators used, skillful use of digital devices is relatively better than other indicators. While the indicator of skillful effective communication in the media is relatively low, this means that the language and symbols used in the media have not been able to convey messages well. The project-based learning method is high in improving practical skills using digital devices and producing good media designs because teaching practice in real life so that trial and error experiences can hone skills to produce better ones. Problem-based learning centers on getting students involved in solving real-world problems. The process of creating a product includes using technology during the inquiry phase, working in tandem with team members, and conducting real researchIn addition, the collaboration encouraged group members to exchange ideas to produce the best product. This is in accordance with the opinion that deep collaboration in project-based learning provides the opportunities for students to exchange ideas, knowledge, and respect each other when there are the dissent within the group (Ariyanto & Muslim, 2019; Degner et al., 2022; Kokotsaki et al., 2016; Zhou, 2023).

Project Based learning can improve students' skills in creating learning media because this method can provide opportunities for students to receive stimuli in the form of information, events, objects, and other interactions. The success of project based learning can be seen in the understanding of the material being taught is very good and the behavior expected from the learning objectives has been achieved (Fadillah, 2021; Sanfo, 2023). Project based learning improves students' ICT literacy skills through the aspects of access, managing, integrating, evaluating, making and communicating, scientific literacy, and (2) successfully equipping the students with the digital/ICT literacy (Kusuma & Artama, 2023; Wilujeng, n.d.). The research details the results of PjBL on skills that refer to media creation which consists of (1) adapting media to learning objectives (2) communicating effectively (3) producing attractive media designs (4) using digital devices (5) integrating text, images, audio, video, and other multimedia elements to enhance learners' understanding. Teaching and learning materials refer to the teaching aids (textbook, workbooks, crayon, pieces of cardboard, etc) that enable and facilitate teaching and learning (Alenezi, 2020; Oppong Frimpong, 2021). The characteristic of good learning material is authentic material in digital form. Authentic learning material may stimulate mental processes (e.g., paying closer attention than when using regular materials, affective processes (e.g., experiencing a sense of familiarity with the material;), and even physical processes when students leave the classroom to visit, say, historical sites, who also highlighted a number of these thought processes that take place when students work with real learning resources. Authentic Digital materials may be ebooks, compiling learning media uploaded on you tube, and organizing

webinars. The skill of making digital teaching materials is measured in seven indicators, skill full in (1) formulating titles, subjects, competency standards, basic competencies, indicators (2) formulating learning instructions (3) formulating objectives to be achieved (4) presenting complete information (5) arranging exercises in accordance with learning objectives (6) preparing work instructions (7) preparing evaluation instruments.

Based on this research, the project-based learning model can improve the skills of making teaching materials. The skill of making teaching materials in compiling learning instructions is the highest skill improvement with the Project Based Learning method. While the indicator of skillfully formulating titles, subjects, competency standards, basic competencies, and indicators is the indicator with the lowest score. This can be caused by preservice teacher already having skills before being treated. In addition, the project-based learning method is relatively high in improving skills in preparing evaluation instruments. The collaboration that occurs is able to improve the skills of compiling evaluations. Based on previous research, project based learning can improve prospective teachers' abilities in Instructional Materials and Media Development (IMALD), including multimedia-based materials and textbooks to teach English to pupils in elementary, junior and senior high schools. Additionally, students in IMALD classes were more satisfied and driven to create educational materials and media for teaching and learning. The advantages of the PJBL are that the students learn how to collaborate with their peers, feel free to create the performance, and practice to communicate their ideas with their peers. However, stated that the project based learning method cannot improve skills in compiling learning materials because PjBL cannot teach phenomena in accordance with research methods (Classrooms & Rakhmawati, 2018; Reka et al., 2023).

The use of digital technology in education has altered how teaching and learning activities which include learning assessments are carried out. The degree of digital literacy among instructors themselves determines how well digital assessment is implemented. Digital assessment may probably be used as effectively as feasible if teachers have a high level of digital literacy (Awang, 2022b, 2022a; Ding et al., 2024). There are four indicators in measuring the skills of preparing asessment instrumens. (https://kurikulum.kemdikbud.go.id). Learners' skills in preparing evaluation tools facilitated by project-based learning method overall improved significantly. Of the six indicators used, the skill of preparing formative evaluation is relatively better than the other skills. Formative evaluation is an evaluation carried out during the learning process. In this case, students compile instruments that measure the level of activeness, discipline, cooperation, and involvement of students during the learning process. In addition, the skill with the lowest gain is the skill in preparing the evaluation rubric. In this case, with project-based learning, students are weak in determining the descriptors in each rubric. What is emphasized in the implementation of TPACK project-based learning,PST's conduct item analysis using the iteman application. The effectiveness of project-based learning method in improving skills is theoretically based on *Lev Vygotsky's Theory of Social Constructivism*. The theory refers to learners as social beings. Learners grow their ways of thinking largely through social interactions. Social constructivist stresses learner-centredness, and a collaborative style of imparting and acquiring knowledge and skills supported by teacher scaffolding and authentic tasks. Project based learning is effective in increasing knowledge and career aspirations (korea), improving critical thinking skills in adult learning with collaboration (Akpan et al., 2020; Dagar, 2019; Huang, 2018; Le, 2021). The implications of the results of this research can be used by teachers in professional teacher programs or educational colleges to teach skills in producing learning tools that are very necessary in carrying out their professional duties as teachers.

4. CONCLUSION

The results of this study state that with the TPACK-based project-based learning model, there is an increase in the skills of developing teaching modules, digital media, teaching materials and preparing evaluations. Based on research results and findings, the project based learning method improves skills in compiling digital learning tools. This is because the project based learning method is student-centred, emphasizing collaboration between students, teachers and parents. Students plan, design and evaluate and reflect on the assigned project, so that the resulting product is better than using conventional methods.In this case, the improving of digital learning media and the preparation of digital teaching resources are relatively higher than other skills.

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6. REFERENCES

Adalikwu, S. A., & Iorkpilgh, I. T. (2013). *The Influence Of Instructional Materials On Academic Perform Ance Of Senior Secondary School Students In Chemistry In Cross River State*. *12*, 39–45. https://www.ajol.info/index.php/gjedr/article/view/91018.

Adu, E. O., & Zondo, S. S. (2024). Enhancing teachers' digital skills in teaching of economics in south african secondary schools. *International Journal of Educational Research Open*, *6*, 100310. https://doi.org/10.1016/j.ijedro.2023.100310.

Akpan, V. I., Igwe, U. A., Blessing, I., Mpamah, I., & Okoro, C. O. (2020). Social Constructivism: Implications on Teaching and Learning. British Journal of Education, 8(8), 49–56. https://doi.org/https://www.sciepub.com/reference/432691.

Al Njadat, E. N., Al-Ja'afreh, S., & Almsaiden, A. H. I. (2021). Educational technology and its impact on the efficiency of the educational process in higher education. *Cypriot Journal of Educational Sciences*, *16*(4), 1384–1394. https://doi.org/10.18844/cjes.v16i4.5987.

Alenezi, A. (2020). *The Role of e-Learning Materials in Enhancing Teaching and Learning Behaviors*. *10*(1). https://doi.org/10.18178/ijiet.2020.10.1.1338.

Aluko, R., & Ooko, M. (2022). *Enhancing the Digital Literacy Experience of Teachers to Bolster Learning in the 21st Century*. *9*(3), 420–435. https://doi.org/10.56059/jl4d.v9i3.662.

Ariyanto, S. R., Munoto, Muslim, S., & Muhaji. (2019). Collaborative Problem-Based Learning Models Implementation in Vocational High Schools. *Proceedings of the 1st Vocational Education International Conference (VEIC 2019)*, 238–245. https://doi.org/10.2991/assehr.k.191217.039.

Awang, M. I. (2022a). The Digitalization of Learning Assessment. *Proceedings of International Conference on Multidiciplinary Research*, *4*(1), 1–7. https://doi.org/10.32672/pic-mr.v4i1.3731.

Awang, M. I. (2022b). *The Digitalization of Learning Assessment. Proceedings of International Conference on Multidiciplinary Research, 4(1), 1–7.*

https://doi.org/10.32672/pic-mr.v4i1.3731.

Ayu, D., Manu, M., Priantini, O., Luh, N., & Karang, G. (2021). *How Effective is Learning Style Material with E-modules During The COVID-19 Pandemic ? 5*(2), 307–314. https://doi.org/10.23887/jisd.v5i2.37687.

Barai, B., & Saha, R. K. (2022). *Technology and creativity in modern classroom* (Issue April). https://doi.org/10.25215/9198758241.

Bond, M., & Bedenlier, S. (2019). Facilitating Student Engagement Through Educational Technology : Towards a Conceptual Framework. 2019(1), 1–14. https://doi.org/10.5334/jime.528.

Cabellos, B., Siddiq, F., & Scherer, R. (2024). Computers in Human Behavior The moderating role of school facilitating conditions and attitudes towards ICT on teachers ' ICT use and emphasis on developing students ' digital skills. *Computers in Human Behavior*, *150*(6), 107994. https://doi.org/10.1016/j.chb.2023.107994.

Chantarasombat, C., & Kaen, K. (2020). The Development of Learning Module of Educational Administration and Educational Institute for Students in Master of Education Degree in Thailand The Development of Learning Module of Educational Administration and Educational Institute for Students in Ma. World Journal of Education, 10(3). https://doi.org/10.5430/wje.v10n3p19.

Chen, J. (2024). Acta Psychologica Impacts of Internet literacy and Internet contact on the communication effect of university students ' ideological and political education in China. *Acta Psychologica*, *247*(5), 104321. https://doi.org/10.1016/j.actpsy.2024.104321.

Classrooms, M. D., & Rakhmawati, I. (2018). Project-Based Learning in Instructional Materials and Media Development Classrooms Isna Rakhmawati. Science, Engineering, Education, and Development Studies (SEEDs): Conference Series Faculty Of Teacher Training And Education Sebelas Maret University, 2(2), 163–170. https://doi.org/10.20961/seeds.v2i2.27556.

Crompton, H., Burke, D., Jordan, K., & Wilson, S. W. G. (2021). Learning with technology during emergencies: A systematic review of K-12 education. *British Journal of Educational Technology*, *52*(4), 1554–1575. https://doi.org/10.1111/bjet.13114.

Crossouard, B. (2009). A sociocultural reflection on formative assessment and collaborative challenges in the states of Jersey. *Research Papers in Education*, *24*(1), 77–93. https://doi.org/10.1080/13669870801945909.

Dagar, V. (2019). Constructivism : A Paradigm for Teaching and Learning Constructivism : A Paradigm for Teaching and Learning. *Arts and Social Sciences Journal*, *7*(4). https://doi.org/10.4172/2151-6200.1000200.

Degner, M., Moser, S., & Lewalter, D. (2022). Digital media in institutional informal learning places : A systematic literature review. *Computers and Education Open*, *3*(12), 100068. https://doi.org/10.1016/j.caeo.2021.100068.

Ding, A. E., Shi, L., Yang, H., & Choi, I. (2024). Enhancing teacher AI literacy and integration through different types of cases in teacher professional development. *Computers and Education Open*, *6*(4), 100178. https://doi.org/10.1016/j.caeo.2024.100178.

Dr. Lohans Kumar Kalyani. (2024). The Role of Technology in Education: Enhancing Learning Outcomes and 21st Century Skills. *International Journal of Scientific Research in Modern Science and Technology*, *3*(4), 05–10. https://doi.org/10.59828/ijsrmst.v3i4.199.

Dwarakanath, L., Kamsin, A., Rasheed, R. A., Anandhan, A., & Shuib, L. (2021). *Automated Machine Learning Approaches for Emergency Response and Coordination via Social Media in the Aftermath of a Disaster : A Review*. 68917–68931.

https://doi.org/10.1109/ACCESS.2021.3074819.

Fadillah, S. (2021). *Workshop Model Pembelajaran Project-Based Learning Berbasis Penggunaan ICT bagi Guru SMAN 2 Kampar Kiri Tengah*. *6*(3), 656–666. https://dx.doi.org/10.30653/002.202163.704.

García, C. (2016). Project-based learning in virtual groups - collaboration and learning outcomes in a virtual training course for teachers. *Procedia - Social and Behavioral Sciences*, *228*(6), 100–105. https://doi.org/10.1016/j.sbspro.2016.07.015.

Gray, J. A., & Diloreto, M. (2016). The Effects of Student Engagement, Student Satisfaction, and Perceived Learning in Online Learning Environments. *International Journal of Educational Leadership Preparation*, 11(1). https://eric.ed.gov/?id=EJ1103654.

Harmawati, Y., Abdulkarim, A., Bestari, P., & Sari, B. I. (2024). Data of digital literacy level measurement of Indonesian students : Based on the components of ability to use media , advanced use of digital media , managing digital learning platforms , and ethics and safety in the use of digital media. *Elsevier*, *54*(1). https://doi.org/10.1016/j.dib.2024.110397.

Hatos, A., Lacrimioara, C. M., & Clipa, O. (2022). *The importance of teacher training from the digital skills ' perspective* (Vol. 8, Issue 1). https://www.scienceopen.com/book?vid=5a8304a2-ef6f-4022-ae8d-156f536d12ce.

Ho, H. C. Y., Poon, K., Ka, K., Chan, S., Cheung, S. K., Alfonso, J., Datu, D., Yeung, C., & Tse, A. (2023). Computers & Education Promoting preservice teachers ' psychological and pedagogical competencies for online learning and teaching : The T . E . A . C . H . program. *Computers & Education*, *195*(11), 104725. https://doi.org/10.1016/j.compedu.2023.104725.

Huang, Q. (2018). Examining Teachers' Roles in Online Learning. *The EuroCALL Review*, *26*(2), 3. https://doi.org/10.4995/eurocall.2018.9139.

Hutabarat, Z. S. (2023). *Development of Teaching Materials on Learning Economic Models to Improve Students ' Cognitive Achievement*. *15(1)*, 1204–1212. https://doi.org/10.35445/alishlah.v15i2.1679.

Jamhari, M., Laenggeng, A. H., Tangge, L., Windarsih, Y., & Agni, R. (2023). *Effectiveness of training program in improving teachers ' skills in developing teaching modules at SMA Negeri 7 Palu*. *20*(03), 1414–1419.

Kurniawati, S., Dahlan, D., Parhah, S., & Hilmiatussadiah, K. G. (2022). Teacher Difficulties on Online Learning in Economics Subject. *JPIS : Jurnal Pendidikan Ilmu Sosial*, *31*(1), 25–40. http://ejournal.upi.edu/index.php/jpis.

Kholifaturrohmah, R., & Mulasiwi, C. M. (2021). Analysis of Technological Pedagogical and Content Knowledge (TPACK) to the Economics and Accounting Teachers. *Dinamika Pendidikan*, *16*(2), 143–155. https://doi.org/10.15294/dp.v16i2.30419.

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature.Project-based learning: A review of the literature. Improving Schools. *Improving School (SAGE Journals)*, *19*(3), 267–277.

Kusuma, K., & Artama, J. (2023). Promoting the 21 st Century Skills Using Project-Based Learning. *Language Circle: Journal of Language and Literature*, *17*(4). https://doi.org/10.15294/lc.v17i2.39096.

Kwon, S. M., Wardrip, P. S., Gomez, L. M., & Policy, S. (2016). Co-design of Interdisciplinary Projects as a Mechanism for School Capacity and Teacher Professional Community Growth. *Improving Schools. 17(1)* https://doi.org/10.1177/1365480213519517.

Le, T. T. (2021). *Project-based Learning in 21st Century : A Review of Dimensions for Implementation in University-level Teaching and Learning*.

https://www.researchgate.net/publication/361412215_Project-based_Learning_in_21st_Century_A_Review_of_Dimensions_for_Implementation_in_University-level_Teaching_and_Learning.

Lewis, T. (2009). Creativity in technology education: providing children with glimpses of their inventive potential. *International Journal of Technology and Design Education*, *19*(3), 255–268. https://doi.org/10.1007/s10798-008-9051-y.

Li, Y., Kim, M., & Palkar, J. (2022). Using emerging technologies to promote creativity in education: A systematic review. *International Journal of Educational Research Open*, *3*(May), 100177. https://doi.org/10.1016/j.ijedro.2022.100177.

Lillo, E. A. G. (2023). European Journal of Educational Research. *European Journal of Educational Research*, *12*(4), 1667–1681. https://www.eu-jer.com/.

Made, D., & Yusana, W. (2023). *Indonesian Journal of Educational Development (IJED) IMPROVING TEACHERS ' Ability To Develop Independent Curriculum Teaching Modules Through Training By School Supervisors At Smk Negeri 3 Tabanan*. *4*(1), 110–117. https://doi.org/10.59672/ijed.v4i1.2874.

Manakane, S. E., & Rakuasa, H. (2023). *The Role of Digital Learning Media in Improving the Quality of Geography Learning : A Review The Role of Digital Learning Media in Improving the Quality of Geography Learning : A Review*. *1(1)*. https://www.researchgate.net/publication/375223951_The_Role_of_Digital_Learning_Media_in_Improving_the_Quality_of_Geography_Learning_A_Review.

Matanluk, O., Mohammad, B., Norizah, D., Kiflee, A., & Imbug, M. (2013). *ScienceDirect The Effectiveness of Using Teaching Module Based on Radical Constructivism toward Students Learning Process*. *90*(1), 607–615. https://doi.org/10.1016/j.sbspro.2013.07.132.

Mo, A. (2024). The Role of Digital Pedagogy in Enhancing Teacher Education. *Research Article*, *1*(3), 1–8. https://doi.org/10.19080/OAJELS.2024.01.555565.

Msila, V., & Setlhako, A. (2013). Teaching (still) matters : Experiences on developing a heutagogical online module at UNISA. *Procedia - Social and Behavioral Sciences*, *69*(Iceepsy 2012), 136–142. https://doi.org/10.1016/j.sbspro.2012.11.392.

Oppong Frimpong, S. (2021). The role of teaching and learning materials and interaction as a tool to quality early childhood education in Agona East District of the Central Region of Ghana. *African Educational Research Journal*, *9*(1), 168–178. https://doi.org/10.30918/aerj.91.20.112.

Panzer, M., & Gronau, N. (2024). ScienceDirect Enhancing economic e ffi ciency in modular production systems through deep reinforcement learning. *Procedia CIRP*, *121*, 55–60. https://doi.org/10.1016/j.procir.2023.09.229.

Permana, D. F., Muhsin, M., Saeroji, A., Afianingsih, L., & Article, H. (2021). *Dinamika Pendidikan*. *16*(2), 182–193. https://doi.org/10.15294/dp.v16i2.33017.

Persichitte, K. A. (2016). *Educational Technology to Improve Quality and Access on a Global Scale* (Issue Etwc). https://cdn.undiksha.ac.id/wp-content/uploads/sites/9/2023/05/15160015/Springer_book-1_compressed-dikompresi-1.pdf.

Pimdee, P., Sukkamart, A., & Nantha, C. (2024). Heliyon Enhancing Thai student-teacher problem-solving skills and academic achievement through a blended problem-based learning approach in online flipped classrooms. *Heliyon*, *10*(7), e29172. https://doi.org/10.1016/j.heliyon.2024.e29172.

Ramaila, S., & Molwele, A. J. (2022). *The Role of Technology Integration in the Development of 21 st Century Skills and Competencies in Life Sciences Teaching and Learning*. *11*(5), 9–17. https://doi.org/10.5430/ijhe.v11n5p9.

Ramatni, A., Anjely, F., Cahyono, D., Rambe, S., & Shobri, M. (2023). *Proses Pembelajaran*

dan Asesmen yang Efektif. *5*(4), 15729–15743. https://doi.org/10.31004/joe.v5i4.2687.

Reka, I. G., Yasa, S., & Asril, N. M. (2023). *Teacher Skills in Developing Project Based Learning (PjBL) Learning Tools in Elementary Schools*. *11*(3), 454–461. https://ejournal.undiksha.ac.id/index.php/JJPGSD/article/view/63921.

Sanfo, J. M. B. (2023). Examining student ICT use and learning outcomes : Evidence from Japanese PISA data. *Computers and Education Open*, *4*(11), 100141. https://doi.org/10.1016/j.caeo.2023.100141.

Setiawan, K., Nurannisaa, S., Ninawati, N., & Yunithree, M. (2021). *The Development of Project-Based Learning Training Module Online for Elementary School Teachers*. *570*(1), 1340–1345. https://www.atlantis-press.com/proceedings/icebsh-21/125959515.

Supriadi, K., Ansari, K., & Adisaputera, A. (2008). *Development of Module Teaching Materials Writing Short Texts of Literacy-Based for Students of Senior High School Parulian 1 , Medan , Indonesia*. 398–409. https://doi.org/10.33258/birle.v2i3.378.

Trif, L. (2015). *Training models of social constructivism . Teaching based on developing a scaffold*. *180*(November 2014), 978–983. https://doi.org/10.1016/j.sbspro.2015.02.184.

Wati, S., & Apriani, E. (2021). *Learning Module Development On Compiling Exposition And Argumentation Text Using Project- Based Learning*. *9*(2), 355–366. https://doi.org/10.25134/erjee.v9i2.4370.

Wicaksono, S. R. (2023). Collaborative Project Based Learning. https://doi.org/10.5281/zenodo.7888582.

Wilujeng, I. (n.d.). *The Effects of Project Based Learning Model with Android on Scientific Literacy and Digital Equipedness / ICT Literacy*. *4531*(1), 190–205. https://www.gssrr.org/index.php/JournalOfBasicAndApplied/article/view/8472.

Yadav, G. (2023). The Role Of Technology In Expanding Access To Distance Education And Improving Educational Outcomes. *Journal of Namibian Studies. 35(1)*. https://doi.org/10.13140/RG.2.2.32091.95520.

Yang, B., Tang, L., Lv, M., Cong, J., & Wang, Z. (2024). Heliyon Analysing the influencing factors of on-line studying engagement of preparatory international students : A case study of the science and technology Chinese course. *Heliyon*, *10*(11), e31761. https://doi.org/10.1016/j.heliyon.2024.e31761.

Zhou, C. (2023). The Impact of the Project-Based Learning Method on Students. *2nd International Conference on Education Reform, Humanities and Social Studies (ERHSS 2023). 9(1)*, 20–25. https://doi.org/10.54691/bcpep.v9i.4603.