

TPACK-Based Team Based Project Learning Design in Improving Digital Literacy Skills

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Abstract. Case method and team-based learning is one of the Key Performance Indicators (KPIs) implemented by the Ministry of Education and Culture of the Republic of Indonesia number 3/M/2021. Case method and team-based project learning is a learning that is charged to students to improve students' critical thinking skills, solve problems, find solutions, and foster communication skills. This learning is also useful for lecturers as teaching staff to improve higher abilities and skills. These learning methods need to be accompanied by an increase in digital literacy by students, whose application certainly cannot be separated from technology. Technology can make classroom learning more effective and efficient. To answer this challenge, the researcher is interested in developing a prototype of a TPACK-based team-based project learning module. This research has the following objectives: (1) Developing the design of a TPACK-based team-based project learning module in the form of a module prototype, (2) testing the feasibility of the module prototype, (3) testing the effectiveness of the module in improving students' digital literacy. The final result of this study is a prototype of a team-based learning design module that is feasible and effective so that it can be used as a guideline for the implementation of learning for the improvement of key performance indicators.

Keywords: TPACK; PjBL; learning design, digital literacy

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INTRODUCTION

The shift in the learning process from educator-centered learning (teacher centered) to student-centered learning (student centered learning) so that students are prepared to be able to construct their own knowledge in order to learn effectively. Students can construct knowledge through education, because education plays a role in producing human resources who have character, quality, and are able to master technology. The industrial revolution 4.0 has changed the way of thinking and innovation in the field of education, so that improving competence and maximizing the potential of each individual must be explored as deeply as possible through the adoption of quality and student-based learning methods. According to the skills that must be possessed to be able to compete in the development of the current industrial revolution, namely the 4C skills which consist of (Rahadian, 2018; Nevrita et al., 2023; Angraini et al., 2023; Andrian & Rusman, 2019) critical thinking and problem solving, creativity, communications skills, and collaboration skills.

According to the ability to think critically (Husna et al., 2019; Changwong et al., 2018) critical thinking) is one of the skills that must be possessed in the 21st century as one of the pillars of economic development. Critical thinking skills cannot just appear, but need to be honed continuously, especially honing attitudes and behaviors that support a person to have critical thinking skills. Critical thinking skills Pradana et al., (2017)

possessed by educators (lecturers) can be displayed or applied in the presentation of learning. According to the success in the learning process to produce students who think critically Rosidah & Pramulia, (2021) critical thinking) is influenced by meaningful learning delivered by educators (lecturers) in developing learning materials. Critical thinking skills must be developed in a variety of learning, so that students can involve how they work, how they think, and how they solve problems (Utaminingsih & Rahayu, 2019).

To improve critical thinking skills in the learning process, it is necessary to apply different methods. One of the methods that can currently be used to improve critical thinking skills is the team-based project learning method. The team-based project learning method is an active learning method through the use of small groups both in the classroom and outside the classroom. The effectiveness of the team-based project learning method will be different for each learning material presented by the educator (lecturer). This learning method requires students to try to find and at the same time try to find solutions to problems found with design product outputs. The team-based project learning style aims to shape students' conceptual and procedural knowledge and their mindset. Cahyani et al., (2023) Team-based project learning aims to be able to encourage students to think at a higher level and better understand the learning content (Saputra et al., 2022).

Educational technology and digital media play a crucial role in the education sector around the world, including universities. Educational technology has great potential to facilitate and enhance student learning for professional contexts, communication and collaboration tools. However, to be able to take advantage of the great potential of educational technology, an educator or teacher must begin to get used to applying it. Technological Pedagogical Content Knowledge (TPACK) is the ability of teachers, namely teachers and lecturers, to carry out learning by integrating learning strategies and technology (Larsen, 2023; Schubatzky et al., 2023). Learning in modern times requires the understanding of a teacher to be able to collaborate learning with technology. TPACK refers to the incorporation of teaching knowledge frameworks such as technology that can improve success in the classroom. The TPACK model is a pedagogical construction that is useful as a theoretical foundation related to the interaction of technological knowledge, pedagogical knowledge, and content knowledge so that the TPACK model is considered by some researchers as the best tool that can be used by a teacher to apply technology in the digital era (Kamsina, 2020; Tan et al., 2023; Su, 2023).

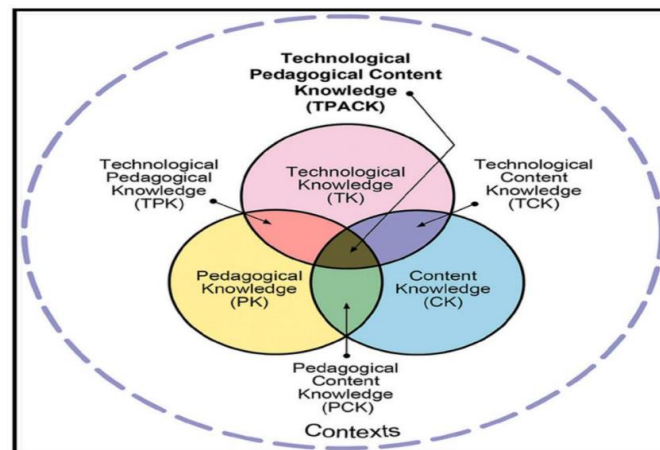


Figure 1. TPACK Framework and Its Forming Components

Source: <http://tpack.org/>, (Schubatzky et al., 2023)

So, the TPACK model is not only a pedagogic aspect, but the technological aspect is also a consideration in the implementation of modern and innovative classroom learning. A professional teacher must have a decent and adequate TPACK competency, because TPaCK is in the realm of four main competencies of a teacher, namely pedagogical competence, personality competence, social competence and professional competence. TPaCK is very important for the ability to compile learning tools, so that teachers can use technology well in learning activities. The TPaCK framework also describes the different types of knowledge required by teachers

to teach effectively with the help of technology and various complex procedures regarding the field of interaction of their knowledge. The use of information and communication technology in learning can be an alternative for these improvements. Therefore, teachers in Indonesia should have these abilities in order to realize national education goals (Sintawati & Indriani, 2019; Suyamto et al., 2020; Rosmalina & Elfrianto, 2024).

According to the World Economic Forum in 2015, there are six basic literacy that must be mastered by every country, namely reading literacy, numeracy literacy, science literacy, digital literacy, financial literacy, and cultural and civic literacy. However, the six basic literacy have not been mastered by the people of Indonesia. It is likely that this is due to low reading ability and interest. Digital literacy is defined as a person's ability to use technology and information from digital devices effectively and efficiently in various life contexts. The use of the internet is very high but not accompanied by an increase in digital literacy skills will cause people to only be able to access information but cannot sort and communicate the information obtained, so that hoax news will spread faster and be detrimental (Wardhani et al., 2019; Jasin et al., 2024; Muliani et al., 2021; Yanti et al., 2021).

Modules are teaching materials that are written with the aim that students can learn independently without or with guidance from teachers. The application of the use of modules makes students more active in the learning process (student center). With modules, students can achieve and complete their learning materials individually. A student cannot proceed to the next unit of study before completing the learning material completely. With modules, students can control their ability and learning intensity. Modules can be studied anywhere. The length of use of a module is not definite, although the module packaging also states the time it takes to learn certain material. However, the flexibility of students to manage this time is very flexible, it can be a few minutes or a few hours, and can be done independently or can be varied with other methods (Laili et al., 2019; Negara et al., 2019).

Based on the description of the advantages of the team-based project, TPACK and the need for digital literacy for students, the development of modules is needed to support the achievement of key performance indicators 7, namely collaborative and participatory learning. For this reason, a study is needed that aims to develop the design of a TPACK-based team-based project learning module to improve digital literacy for students. This module has never been developed before, especially in higher education, so this research is important to be carried out. The development of team-based project learning modules is expected to help students solve various cases or problems in daily life and can also increase the achievement of key performance indicators.

METHODS

The research method used is the ADDIE model development method. The ADDIE model is the most commonly used model in the field of instructional design to produce an effective design. This model is an approach that helps in creating instructional design, content development, or even to create an efficient and effective teaching design by applying the stages of the ADDIE model to instructional product design, the stages of ADDIE include (Hidayat & Nizar, 2021) Analysis, Design, Development, Implementation, Evaluation (Sugihartini & Yudiana, 2018). This ADDIE model has previously been used in research Fadhli et al., (2023) to develop a team-based environmental project learning design on digital learning.

The Research Procedures according to the stages of ADDIE are implemented as follows: analysis, design, development, implementation, evaluation. Analysis. In the information collection analysis activity, it was carried out to collect data on the implementation of team-based project learning, analyze the needs of students and lecturers in team-based project learning. At this stage, the strengths and weaknesses of the implementation of team-based project learning that are usually carried out in student learning will be analyzed.

Design. Develop a Prototype of a TPACK-based team-based learning module based on what has been obtained from the results of the analysis. Furthermore, develop an instrument for validating module prototype

designs to material experts, linguists and media experts. Another instrument that needs to be developed is an instrument to measure the improvement of students' digital literacy skills.

Development. At this stage, the development of a team-based project learning module product based on TPACK is carried out. Product development of modules involves a specific platform to make the display more attractive. Furthermore, product validation is carried out to find out whether the program is worth testing to students or still needs revision. Design validation is carried out by experts, in this study, namely material experts, linguists and media experts.

Implementation. At this stage, a Product Trial is carried out after the product is validated by experts, both media experts and material experts. The product was tested on research samples at Universitas Negeri Semarang and at Universitas Negeri Yogyakarta. Testing can be carried out by experiments to determine the improvement of students' digital literacy skills. Experiments can be carried out by comparing with the state before and after using the product.

Evaluation. The evaluation stage in this learning is carried out until the formative evaluation aims to meet the needs of revision. Based on the results of the expert review and field trials that have been carried out in the previous stage, two stages of data analysis are then carried out, namely qualitative data analysis and quantitative data. Qualitative data analysis is used to process data in the form of inputs, suggestions and criticisms from experts and field tests for further gradual revision for better media development. Meanwhile, quantitative data analysis was obtained from respondents' assessments in the form of numbers in the questionnaire given. All of these evaluation stages aim at the feasibility of the final product. Decent in terms of content, design and *user friendly*.

RESULTS AND DISCUSSION

The development of the ADDIE (*Analysis, Design, Development, Implementation, Evaluation*) model applied in this study is explained as follows: Analysis, Design, Development, Implementation, Evaluation.

Analysis

The analysis stage is carried out observation to collect data related to the implementation of team-based project learning, analyze the needs of students and lecturers in team-based project learning. At this stage, the strengths and weaknesses of the implementation of team-based project learning which have generally been implemented in student learning will be analyzed. Needs analysis data was obtained from Universitas Negeri Semarang and Universitas Negeri Yogyakarta with 21 lecturers, 41 lecturers and 150 students. The results are as follows: 90.9% of lecturers and students need TPACK-based team-based project learning design guidelines to increase knowledge. 95.5% of lecturers and students agreed that the TPACK-based team-based project learning design guidelines are useful for FIPP lecturers and students in the preparation of classroom lecture implementation. 95.5% agreed that lecturers and students need to know various university policies related to the implementation of team-based projects in the classroom. 100% agree that in developing TPACK-based team-based project learning design guidelines in both Indonesian and United Kingdom. 95.5% agreed that FIPP lecturers and students need guidelines and real examples of the implementation of TPACK-based team-based learning design designs. 95.5% agreed that faculty of education lecturers and students need special TPACK-based team-based project learning design guidelines for faculty of education in accordance with the field of science and study

Meanwhile, regarding the form of TPACK-based team-based learning design guidelines, the results were obtained according to Figure 1.

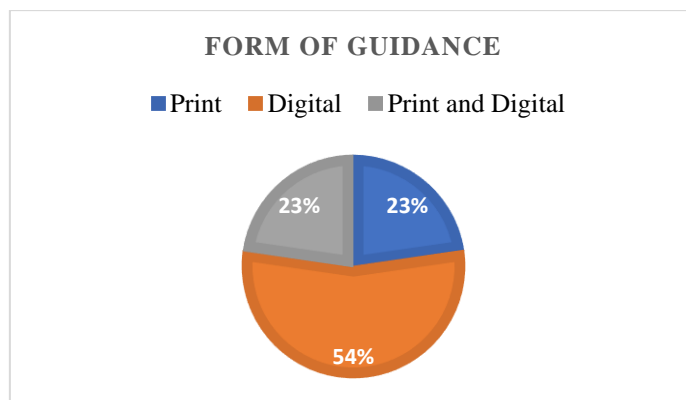


Figure 1. Handbook Form

Based on Figure 3. It was explained that 22.7% of lecturers and students need TPACK-based team-based project learning design guidelines in printed form, 54.5% need in digital form and 22.7% of TPACK-based team-based project learning design guidelines are needed in print and digital form.

Design

This stage is implemented by compiling a prototype of a TPACK-based team-based project learning module based on the results of initial observations that have been obtained from the analysis results. Furthermore, develop instruments for validating module prototype designs/guidelines to material experts and linguists. Another instrument that needs to be developed is an instrument to measure the improvement of students' digital literacy skills.

Development

At this stage, the development of a TPACK-based team-based project learning guidebook product is carried out. Product development of modules involves a specific platform to make the display more attractive. Furthermore, product validation is carried out to find out whether the program is feasible to be tested to students or still needs revision. Design validation is carried out by experts, in this study, namely material experts, linguists. The feasibility test of the guidebook was carried out by validating the material experts, and 86% were obtained while 84% were obtained from linguists.

Implementation

At this stage, product trials are carried out after the product is validated by experts, linguists and material experts. The product was tested on research samples at Universitas Negeri Semarang and Universitas Negeri Yogyakarta. Testing can be carried out by experiments to determine the improvement of students' digital literacy skills. Experiments can be carried out by comparing with the state before and after using the product. The Implementation Stage has not been implemented.

Evaluation

The evaluation stage in this learning is carried out until the formative evaluation aims to meet the needs of revision. Based on the results of the expert review and field trials that have been carried out in the previous stage, two stages of data analysis are then carried out, namely qualitative data analysis and quantitative data. Qualitative data analysis is used to process data in the form of inputs, suggestions and criticisms from experts and field tests for further gradual revision for better media development. Meanwhile, quantitative data analysis was obtained from respondents' assessments in the form of numbers in the questionnaire given. All of these evaluation stages aim at the feasibility of the final product. Decent in terms of content, design and user friendly. The evaluation stage awaits the results of the implementation stage.

Team-based project learning, students must make their own plans to collect information, so that it is more challenging and practical. Students will be active agents and teachers are the facilitators so that students can determine the pace, way of learning, and the knowledge they gain. Team-based project learning has an impact on skills, problem solving, communication, and student group participation (Kim & Kim, 2021; Ramadhan et al., 2019; Webster, 2017). So that it also affects the leadership development of each individual student involved (Sonnenberg-Klein & Coyle, 2024). To improve team function in team project-based learning, *team building* is needed to set goals, develop interpersonal relationships, clarify each of their roles in the team, and develop additional capacity to solve problems. This improvement in team function can be done independently by students in class, so that cooperation between team members will be stronger. Team-based project learning is more student-centered learning by involving projects as an activity as well as a learning medium used for exploration, assessment, interpretation, and information synthesis to produce learning outcome products (Akaki et al., 2022; Suartama et al., 2022).

According to the research Cahyani et al., (2023) on learning with a team-based project model based on digital literacy, it was declared effective. This is shown by students' positive responses to learning, including in interaction, discussion, asking questions, and working together to solve problems. The use of digital platforms in the learning process requires students to improve their digital literacy skills. Digital literacy is seen as a catalyst for educational innovation because it results in the development of new digital media teaching resources and the young generation will be better prepared to evaluate information and distinguish facts from fiction because digital literacy is a way to defend against manipulation, inappropriate persuasion, or even fraud. In health students, digital literacy is urgently needed to facilitate effective communication and collaboration among other health care providers. This shows that digital literacy must be mastered by a person regardless of the field they will pursue. Digital literacy is one of the keys to communication so that it can run effectively and the abilities of each individual are of course at different levels.

According to digital literacy, it must be empowered and improved through active, student-centered learning based on the TPACK framework. International benchmarks related to a person's digital literacy with respect to their educational status have limited significance, so they must be measured through surveys using the TPACK framework. Therefore, students as active agents in learning must and must master digital literacy, of course support is needed in the form of a curriculum supported by digital literacy. Students without digital literacy skills will have difficulty facing the learning process that integrates technology in the process. This is shown in the research findings that digital literacy has a positive effect on self-success using digital technology. This situation not only requires students to have digital literacy skills, but teachers as facilitators must also strive to develop their digital literacy skills for the smooth communication and learning process in the classroom.

This is explained in the research that every educator not only has knowledge and skills in the world of education but must have perseverance and motivation that allows to gain and improve digital competencies as part of the lifelong learning process and training programs are needed to achieve the optimal level of digital skills. TPACK also helps teachers to design and implement measures to encourage the integration of technology in education (Fadhli et al., 2023; Rahmawati et al., 2024; Siriwattanarat et al., 2024; Lankshear & Knobel, 2016; Aydınlar et al., 2024; Angraini et al., 2023; Mödinger et al., 2023; Getenet et al., 2024; Kulaksız, 2023; Sánchez-Cruzado et al., 2021; Sofyan et al., 2023).

The potential of technology in the world of education can be developed using the TPACK framework as an integration of technology in the classroom (Basori et al., 2023; Sheffield et al., 2015) that has a positive impact on the integration of knowledge to support and update the development of professional teachers, the digitally literate generation, and educated human resources (Polycarp et al., 2023; Altun, 2019; Papanikolaou et al., 2017). The integration of technology in the world of education is considered an important prerequisite to support students facing the digital future. Because, the priority of teaching in this modern world has shifted, so the teaching model must keep up with the times (Backfisch et al., 2024; Shafie et al., 2019).

However, according to teachers, they still have difficulties in designing learning that is integrated with this technology in a student-centered learning process (Koh, 2019). Meanwhile, according to Ammade et al., (2020; Hy et al., (2024) the teaching materials prepared using the TPACK strategy, it is considered more interactive and effective in improving student skills and for teachers to expand knowledge and integrate content through technology, diversify teaching and support student-centered learning. In addition, according to the TPACK framework, which is combined in multimodal digital teaching, it is able to improve students' critical thinking skills effectively. explained that teachers need to consider the TPACK model as a suitable paradigm for the analysis of new learning tools that are widely spread in universities. TPACK is also considered to influence the perception of EFL teachers in the preparation of lesson plans, observations and the provision of input for their students. The utilization and transformation of information and communication technology as a cognitive partner in the learning process is an effective and efficient thing within the framework of TPACK. This shows that inevitably teachers must start integrating technology in the learning process to be more effective (Setyo et al., 2023; Baeza González et al., 2023; Basori et al., 2023; Kadioğlu-Akbulut et al., 2023).

According to research findings, Angraini et al., (2023) active learning models such as PBL, RQA, PBL-RQA combined with the TPACK method can improve students' digital literacy and science. Improving one's digital literacy skills allows them to more easily and quickly adapt to a new environment, so that the competitiveness of each individual will increase. According to TPACK, which is integrated with core content and core competencies, it can be used to formulate learning in accordance with teacher competencies, so that it can help prepare teaching professionalism. TPACK is also combined with design-based learning (DBL) in the research and the research recommends to teachers to develop an understanding of TPACK actions through learning activities. The selection and development of learning media that utilize the TPACK method is expected to be able to increase student activity in learning so that it is more meaningful. However, the quality of human resources in dealing with science and technology must also be improved, because the use of ICT in universities is growing rapidly so that a constructive learning environment is needed (Angraini et al., 2023; Marlina et al., 2023; Baran & Uygun, 2016; Nevrita et al., 2023; Max et al., 2023).

Based on this description, it is concluded that the integration of technology in all aspects of life will basically have a positive impact if it can be used as well and wisely as possible, one of which is in the field of education for the learning process in the classroom. The importance of digital literacy skills mastered by students in team-based project learning is one of the keys to effective communication between team members. Cooperation between members without effective communication will not produce good learning outcomes. Digital literacy is also intended to improve critical thinking skills in students so that it is not easy to trust existing information without finding out the truth, finding out the origin of a concept and its application, and so on. However, the extent to which each individual student's ability to apply technology in the learning process must be measured through the TPACK concept which has been proven effective and efficient to be used to improve students' digital literacy by several previous researchers.

Therefore, considering the importance of the application of the TPACK framework in the process of developing students' digital literacy skills, it is necessary to develop a module or guide that examines the application of the TPACK framework in team-based project-based learning that is adapted to actual field conditions and based on the observation findings of the guidebook, 50% of lecturers and students choose to print or print. It is explained in the research findings Maor, (2017) that most students become digital educators and take advantage of the opportunity to apply the TPACK model in their classrooms and the findings of modeling the use of technology in learning are essential for developing TPACK and educator professionalism (Wang et al., 2018).

CONCLUSION

The development of technology in the world of education has shifted the learning paradigm that was initially teacher-centered to student-centered, thus requiring students to be more active during the learning

process. Technological developments also require every student to have critical thinking skills, especially in the team-based project learning system to understand the learning content. The integration of technology in learning can be done with the TPACK framework and this framework requires digital literacy skills. The limitations of students and teachers in understanding the TPACK concept in its entirety in the team-based project learning process require a guidebook that examines the concept both in print and digital form. This guidebook is needed to support the development of the TPACK concept in student team-based project learning to improve their digital literacy.

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