The Influence of the TPACK Approach (Technological Pedagogical Content Knowledge) in Curriculum Management and Learning based Kurikulum Merdeka

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Abstract: Currently para Teachers are faced with generation Z students whose characteristics tend to be more open to new things, interactive communication with fast feedback, liking global issue themes, and having the ease of accessing thousands of information sources from the internet. By integrating application technology, it is hoped that the learning and assessment process will be more effective and enjoyable. However, on the other hand, the digital-based learning process has not been fully implemented. These challenges stem from teachers' lack of skills in using technological tools, technological infrastructure in schools is not evenly distributed, the condition of students who do not have adequate technological tools, and school culture is still not open to the importance of integrating technology in learning. The research aims mdescribe the application of the TPACK (Technological Pedagogical Content and Knowledge) approach in curriculum and learning management, identify factors that influence the application of the TPACK approach, and evaluate the relationship between TPACK and relevant contextual factors. This research uses the SLR (Systematic Literature Review) qualitative approach method which uses literature studies as the basis for data collection, and begins with gap analysis using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) method. The research results show that the application of the TPACK approach in learning has a significant influence on the successful implementation of the Merdeka Curriculum. However, there are still several obstacles such as the lack of adequate training for teachers, limited technological infrastructure, the condition of school culture and the readiness of the devices that students have at home.

Keywords: Independent Curriculum, TPACK Approach.

Introduction

In line with the implementation of the Independent Curriculum which carries the spirit of imparting learning to the learning needs of students, the use of information and communication technology tools in learning should be integrated into the teacher's pedagogical syntax when teaching. Now, teachers are faced with students who were born as generation Z, namely those who were born and raised in the era of digital technology, the internet and social media. The characteristics of these students are that they are more open to everything, global issues, and have the ease of accessing thousands of reference/information sources. By integrating application technology, it is hoped that the learning and assessment process will be more effective and enjoyable, so that it can boost the potential of diverse students. This is in line with fThe philosophy of

education taught by Mr. Ki Hajar Dewantara states that education should guide all the nature and nature of the times in children to achieve the highest happiness and safety (*well being*). So teachers' current learning methods are certainly different from previous conventional learning. Learning transformation must be immediately mobilized on a massive scale in various educational institutions in Indonesia. However, the reality in the field is that many teachers still use conventional learning methods, especially the one-way and monotonous lecture method. This has an impact on students' lack of activeness, weak critical reasoning competence, and students' low creativity in solving problems (*problem solving*).

On the other hand, the implementation of education in the Industrial Revolution 4.0 era must use a curriculum that integrates technology *cyber* both physically and non- physically in the learning process. A The curriculum should carry out an analysis of students' needs, the world of work, and developments in science and technology (Fitri Winarni, 2024). So, *point* What is urgent at the moment is that the reality of the national education system must be to be able to answer global challenges, namely the readiness of school graduates to face changes in technological progress and the demands of the world of work. The results of research conducted by (Sudirman et al., 2020) show that teachers' obstacles lie in the planning, implementation in the classroom and evaluation stages. These obstacles are related to teachers' understanding and skills in using creative and innovative methods, school environmental conditions, facilities and infrastructure, and available human resources.

The ideal teaching process is not just about transferring knowledge, but teachers are required to be able to ignite students' learning motivation in a fun and meaningful learning environment. To be able to make students learn, teachers need to create learning experiences. In other words, teachers need to transform knowledge into learning experiences. So that students are able to understand and construct knowledge well, teachers must also master this knowledge. Amid the increasing availability of digital learning resources and computer networks, the potential for transforming knowledge into diverse and interesting learning experiences is also increasing.

However, research on the use of instructional technology reveals that teachers often do not have the knowledge to integrate technology in their teaching and their efforts tend to be limited in scope, variety, and depth as mentioned by Koehler et al. in Spector et al. (2014). Technology is used more as a tool to increase efficiency and additional tools (McCormick & Scrimshaw, 2001) rather than as a tool that can fundamentally change the nature of a subject as written by Koehler et al. (Spector et al., 2014).

Implementation of the Independent Curriculum in Indonesia requires educators to continue to adapt to changing times, one of which is by integrating technology in the learning process. Approach Concept *Technological Pedagogical Content Knowledge* (TPACK) becomes very relevant in this context, because it emphasizes the teacher's ability to combine pedagogical, content and technological knowledge in learning design. Previous research has shown that TPACK has great potential in improving the quality of learning. However, there are still several research gaps that need to be explored further, especially in the context of implementing the Independent Curriculum. Some gaps (*research gap*) found among others.

First, there is a lack of research that specifically examines the implementation of TPACK in overall curriculum management. Most studies only focus on the

implementation of TPACK in one or a few subjects. Second, most previous research focuses more on the general influence of TPACK on student learning outcomes. However, there is not much research that specifically examines the influence of TPACK on specific dimensions of the Independent Curriculum, such as the Pancasila student profile, student-centered learning, or authentic assessment. Third, even though there is a lot of potential, implementing TPACK in the field is often faced with various obstacles, such as lack of technological infrastructure, lack of teacher training, or resistance to change. Further research needs to be conducted to identify and overcome these barriers. Fourth, previous research often ignores the influence of contextual factors such as school culture, government policies, or student characteristics on TPACK implementation. More comprehensive research needs to consider these contextual factors.

Therefore, this research aims to determine the extent of the influence of the TPACK approach (*Technological Pedagogical Content Knowledge)* in Curriculum Management and Independent Curriculum-based Learning. Through the use of digital technology in the learning process, teachers are expected to be able to understand and implement the TPACK approach correctly, effectively and purposefully so that teachers can transform knowledge into interesting and meaningful learning experiences for students. This research aims to identify the extent to which the TPACK approach has been applied in curriculum management and learning based on the Merdeka Curriculum. More specifically, this research will answer the questions: How is the TPACK approach implemented in curriculum management and learning in schools that have implemented the Independent Curriculum? What are the obstacles and challenges faced by teachers in implementing the TPACK approach? Is there a significant relationship between the implementation of the TPACK approach and contextual factors in schools?

The main aim of this research is to contribute to the development of best practices in the use of TPACK in the context of the Merdeka Curriculum. Specifically, this research aims to: Describe the application of the TPACK approach in curriculum and learning management. Identify factors that influence the implementation of the TPACK approach. Evaluate the relationship between TPACK and relevant contextual factors.

Method

This research uses a qualitative approach of the SLR type (*Systematic Literature Review*) namely using literature studies as the basis for data collection. The data collection technique in this research is by tracing sources of information in various research articles published in scientific journals and several trusted websites that are concerned with the field of education.

The method for writing the research results of this article review begins with a gap analysis followed by the PRISMA method (*Preferred Reporting Items for Systematic Reviews and Meta-analyses*). There are five stages in the PRISMA method,

namely: 1) defining eligibility criteria, 2) determining information sources, 3) data selection, 4) data collection, and 5) data retrieval.

In the first stage, define eligibility criteria based on inclusion criteria (IC) and exclusion criteria. The inclusion criteria were used as general guidelines for reviewing this article. Meanwhile, exclusion criteria are the characteristics of articles that do not meet the inclusion criteria and therefore cannot be used for various reasons. There are two inclusion criteria (IC) used, namely (1) original research articles that have been written and reviewed in Indonesian with a limit of publication year in the last 10 years (IC1); and (2) the articles used as review material are articles that focus on discussing the implementation of learning communities in educational units along with other matters related to learning as the impact of implementing learning community activities (IC2).

In the second stage, determine the source of information. The data used in this review comes from several data source bases *online* which has huge implications for academic studies. Some of the database sources used are *Google Scholar* and *Open Knowledge Maps.* Determining the source of information using several keywords so that the data obtained is in accordance with the desired target. The data obtained and in accordance with the inclusion criteria were also searched for references to find out whether there were other related studies that were in accordance with this research. In the third and fourth stages, data selection and collection. At this stage, the articles that have been obtained are then scanned based on data suitability (IC2). This data scanning is carried out to narrow the search space to a few keywords. The data selection process was carried out in 4 stages, namely (1) Searching for data based on keywords that are appropriate to the research objectives such as learning community, improving teacher quality, learning quality, quality of educational services; (2) Exploration and selection of titles, abstracts and keywords in articles from search results based on previously defined eligibility criteria for research; (3) Read complete or partial articles that have not been eliminated in the previous stage to determine whether they need to be included in the next study according to existing eligibility criteria; And (4)

Review the reference list of the selected article to find other related articles. Next, data collection was carried out by data extraction.

In the fifth stage, namely data collection, information taken from each article includes (1) Study of the definition of a learning community from various expert opinions; (2) Study of the goals, benefits and role of learning communities; and (3) Study of the implementation of the independent curriculum through learning communities.

Results and Discussion

It is still not lost in many people's memories about the pandemic situation which has reminded us that the use of technology in learning will be more common in the future. The pandemic has "forced" teachers and students to learn to use devices and applications that were previously unthinkable so that learning can continue to be carried out outside the classroom. We have been using this technology for about 4 years, it would be a shame if knowledge of this technology was neglected after schools reopened. Meanwhile, many people have predicted that the future of education in the world will move towards hybrids, so that the use of technology in learning cannot be avoided.

In the learning approach, TPACK elements include technology (*technological knowledge*) to facilitate the delivery of teaching materials, pedagogy (*pedagogical*

knowledge) which involves the selection of models and methods, as well as content (*content knowledge*) which contains learning material (Janah, 2022). In this context, Mishra & Koehler (2008) introduced the term *Technological Pedagogical Content Knowledge* (TPACK) which is defined as a way of thinking about the knowledge that teachers need to master to integrate technology effectively in the classroom. The TPACK approach contains coverage of the components of technology knowledge, pedagogy, and subject matter content, as well as understanding the complex interactions between these three components.

An educator in this century needs to have understanding and expertise in the use of technology, both conventional and modern, in order to facilitate the learning process and improve the quality of learning outcomes. Education 4.0 also requires educators to have the ability to master technology to be used in developing the learning process.

Providing training and support to teachers and schools is effective in improving the quality of learning in the classroom. If teachers understand and apply the TPACK learning model, it can be predicted that the teacher's capacity to increase student learning motivation will increase (Adji et al., 2022). On the other hand, some teachers admit that they do not have the ability to teach using the TPACK model (Surahman et al., 2020). This situation may be experienced by educators who are not familiar with the use of ICT in learning.

Other research says that TPACK-based modules need to be developed (Huda et al., 2017). The TPACK-based learning method is not only the integration of the latest technology into the learning framework (Hayani & Sutama, 2022). However, a transformation from a disciplinary perspective to a pedagogical approach is also needed. The development of TPACK can produce new innovations in combining ICT in learning, which can then increase the progress of teacher competence (Ananda & Rahma Rani, 2022). Apart from that, several studies have shown that implementing TPACK-based learning can also increase students' motivation and achievement of learning outcomes.

Progress in education is influenced by the success and quality of prospective teachers. Mastery of TPACK-based learning is important knowledge for teachers so that they can effectively use technology in the learning process in the Era of Society 5.0 (Khaira et al., 2021).

Today's educators not only help students to build their own learning, but also strengthen and improve students' technological literacy. It is hoped that educators can use technology-based instructional approaches in the digital era when students are accustomed to various new technologies and the explosion of information.

Implementing the TPACK approach in schools certainly has advantages and disadvantages. The advantages of applying the TPACK approach in learning are that it can increase students' understanding through the involvement of technology, increase teacher competence in integrating technology in learning, students who are actually a generation of challenge lovers discover new things in their learning process, complex learning content can be simplified with features- technology application features, as well as assisting teachers in achieving learning goals.

On the other hand, the weakness of the TPACK approach is that it requires additional supporting facilities which are not cheap, in the form of providing technological devices. If teachers cannot monitor their students carefully, then technology is vulnerable to misuse, while for students who are still technologically illiterate, they could be left behind by their technology-savvy friends. Uneven internet

access can increase the gap in the quality of education services, if teachers are not yet very skilled at using it. technology, then the teacher's time can be taken up only to focus on understanding the use of technology.

Based on the literature review, there are several research results that show that there is a significant relationship between the implementation of the TPACK approach and contextual factors in schools, such as the availability of technological infrastructure, school culture, government policies, and student characteristics. Therefore, it is important to ensure that teachers have good abilities in utilizing technology and also the readiness of the available technological infrastructure to support the implementation of TPACK. Effective implementation of TPACK requires synergy between teacher knowledge about technology, pedagogy and content, as well as a school environment that supports the use of this technology. The following Figure 1 illustrates the significant correlation between contextual factors that play a role in the success of the TPACK approach in schools.

From the illustration in Figure 1 above, it shows a mutually supportive correlation between achieving successful implementation of TPACK in schools and the contextual factors found in the education unit.

First, Availability of Technology. Schools that have good technological infrastructure such as computers, tablets, internet access and educational software will find it easier to adopt the TPACK approach. On the other hand, schools with limited technology will face greater challenges in integrating technology into learning. Teachers in schools with limited access to technology may only be able to focus on pedagogical and content aspects, without maximizing the technological aspects of TPACK.

Second, School Management and Policy Support. Schools that have policies that support the use of technology in the teaching and learning process will encourage teachers to develop their TPACK knowledge. The research results show that there is an important role for school principals in improving teacher TPACK competence in the digital era. Furthermore, (Rachman, A. D. & Karwanto., 2021) stated that *leadership content knowledg*and School principals are able to influence, mobilize, develop and empower teachers in improving TPACK competencies in the digital era supported by pedagogical knowledge and mastery of technology.

Third, Teacher Competency in Mastering Technology. According to Siringoringo, R. G. & Alfaridzi, M.Y. (2024) states that pTechnology-based education offers opportunities for increased accessibility, flexibility, personalization of learning, and innovation in teaching methods. Interpreting the results of using technology in education is important to optimize its benefits. If teachers have weak technological literacy skills, then implementing the TPACK approach will be difficult. On the other hand, teachers who have adequate technology application skills will find it easier to integrate technology with relevant content and pedagogy.

Fourth, School Culture. A school cultural climate that is open to change and innovation will make it easier to adopt the TPACK approach. Schools that have a collaborative culture between teachers, provide teachers with opportunities for various good practices and technology application resources, will accelerate the implementation of TPACK. A conservative culture or resistance to technology can be an obstacle to the successful implementation of TPACK.

Fifth, Condition of Students. Students who have good access to technological devices outside the classroom such as laptops, smartphones, tablets at home, tend to more easily utilize technology-based learning approaches. Meanwhile, students from

economically disadvantaged backgrounds may have limitations in utilizing technology outside of school, which may limit the effectiveness of the TPACK approach.

Sixth, Professional Training and Development. The training provided to teachers regarding technology, pedagogy, and content is essential in implementing TPACK. Ongoing and relevant training will help teachers develop the ability to integrate technology effectively. Contextual factors such as availability of time for training and access to learning resources also have a big influence.

Seventh, Local and Regional Challenges. Each school is situated in a different local context, such as geographic, social and economic factors. For example, schools in urban areas may have easier access to technology than schools in rural areas that are far from technology centers. This context needs to be considered in implementing TPACK so that technology truly has an optimal impact on learning.

Conclusion

Based on the research results, it can be concluded that the application of the TPACK approach in learning by teachers has a significant influence on the successful implementation of the Merdeka Curriculum. Teachers who have strong TPACK competencies tend to be more innovative in designing learning that supports students, create an interactive learning environment, are able to use technology effectively, and produce better student learning achievements. However, there are still several obstacles such as the lack of adequate training for teachers, limited technological infrastructure, the condition of school culture and the readiness of the devices that students have at home. In the future, this research opens up opportunities for further research. Future research can dig deeper into studying the long-term impact of increasing TPACK mastery on student learning outcomes and teacher professional development.

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