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Implementation of the TPACK Model in Changing Mindsets Towards Zero Digital in Schools

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Abstract
This article discusses the application of the TPACK (Technological Pedagogical Content Knowledge) model in school learning. At present, there are still many parents and some schools that still apply zero digital, because they think that technology can have a negative impact on students. The purpose of this research is to show that the use of technology is needed and beneficial in the learning process of students at school. This research uses a qualitative method with a literature study approach. This research utilizes a variety of written sources, including books, scientific journals, institutional reports, and other relevant literature as the primary source of data in the process of collecting information. Although there are challenges in implementing this model, such as limited access to technology and training, teachers succeed in creating an interactive and effective learning environment.

Keywords: Educational Technology, Technology Pedagogical Content Knowledge (TPACK), Digital Zero, Mindset

Abstrak
Artikel ini membahas penerapan model TPACK (Technological Pedagogical Content Knowledge) dalam pembelajaran di sekolah. Pada saat ini, masih banyak orang tua dan sekolah yang menerapkan zero digital, dikarenakan menganggap bahwa teknologi dapat membawa dampak negatif bagi peserta didik. Tujuan penelitian ini adalah untuk menunjukan bahwasanya penggunaan teknologi sangat dibutuhkan dan bermanfaat dalam proses pembelajaran peserta didik di sekolah. Penelitian ini menggunakan metode kualitatif dengan pendekatan studi pustaka atau kajian literatur. Penelitian ini memanfaatkan beragam sumber tertulis, meliputi buku, jurnal ilmiah, laporan institusi, dan literatur relevan lainnya sebagai sumber primer data dalam proses pengumpulan informasi. Hasil analisis tematik menunjukkan bahwa penggunaan teknologi tidak hanya memperkaya proses pembelajaran, tetapi juga meningkatkan pemahaman siswa tentang bagaimana pemanfaatan teknologi dalam kehidupan sehari-hari dan diterapkan ke hal-hal yang lebih positif. Meskipun terdapat tantangan dalam penerapan model ini, seperti keterbatasan akses teknologi dan pelatihan, guru berhasil menciptakan lingkungan belajar yang interaktif dan efektif

***Kata kunci**: Teknologi Pendidikan; Teknologi; pedagogi; pengetahuan konten (TPACK)**;** nol digital, kerangka berpikir*

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Introduction

Digital technology is often used as a learning medium which has now become a *trend* in the world of education that cannot be avoided. The reason is, technology has provided a lot of access that has been channeled into information sources, interactive teaching aids, and also a fairly interesting learning environment. In this digital era, the use of technology must be utilized and can be used in daily life. Because to increase the effectiveness of learning, expand various methods in learning and teaching, making it easier for teachers and students to communicate. Learning can be enhanced in innovative and creative ways. Combining information and communication technology (ICT) with content pedagogical technology knowledge (TPACK) is one way to improve education in the 21st century. TPACK itself is a development of (Hardian Tomi, 2023) (Dr. Fatma Sukmawati et al. 2022) *pedagogical content knowledge* (PCK) proposed by Shulman, (1986). Mishra & Koehler, (2008) developed the scope of PCK by adding technological elements in it. So that TPACK becomes a form of knowledge that is interconnected, between content, pedagogy, and technology.

Technology, pedagogy, content knowledge (TPACK) is one of the new skills that teachers need to master if they want to use technology effectively in the classroom. TPACK has evolved into a widely used tool for assessing teachers' knowledge of the use of technology in education. The ability in TPACK can affect the readiness of teachers to become professionals. Teachers can encourage student engagement and improve their understanding of the learning material by using the right TPACK model. TPACK's approach provides evidence that (Herna Susanti, 2023) *content knowledge* combined with pedagogic and technological skills is a very important component when it comes to creating innovative and effective classroom teaching that uses *technology*. Therefore, teachers must be able to take advantage of technological developments in the learning system. Teaching must be seen in the form of interaction between classroom application and teacher knowledge. For important subjects and concepts in a given class, integration efforts should be designed creatively or structured. (Nisa et al., 2024)

Based on the description above, this study aims to show that the use of technology is needed and useful in the learning process of students at school. The focus of this research is how the application of the TPACK (*Technology Pedagogical Content Knowledge*) model can change the way educators and students see the use of technology in the learning process in schools, especially in the context of the "*zero digital*" phenomenon.

In an article entitled "Parents' Knowledge About the Use of *Gadgets* in Preschool Children" written by Ni Luh Made Asri Dewi, Ida Bagus Candra Wibawa Manuaba that there are still many parents who do not agree with the use of technology in learning, because they are afraid that it can damage and have a negative impact on children. So that the parents send their children to schools that implement *digital zero*. Therefore, this article discusses the importance of applying and utilizing technology in education to help children's development in processing and using technology to positive things.

The research entitled "*Development of Balaghah Teaching Materials based on Technology, Pedagogy, and Content Knowledge theories for* IAIN Tulungagung" revealed that TPACK can

increase the motivation of students to learn Balaghah at IAIN Tulungagung. (Saputra et al., 2023)

The findings of previous research taken from the journal entitled "Development of TPACK Framework Learning Tools to Improve Learning Understanding TPACK Framework to Improve Students' Concept Understanding" found that TPACK-based learning tools have actively optimized student learning activities and are able to improve students' concept understanding and all TPACK components are related to each other and have a great impact in learning. (Dita Apriliani, 2017)

Some of these previous studies revealed that TPACK has many benefits in the world of education. The benefits of applying this model are increasing students' learning motivation and helping to optimize learning activities for students to be more active and effective. In this case, the research can be used as a reference and supporting factor for the need to apply the TPACK learning model in the world of education.

Method

This study applies a qualitative method using a literature study or literature review approach. This research utilizes various written sources, including books, scientific articles, and other relevant literature studies as primary sources of data in the information collection process. This qualitative category generally provides data results such as notes and textual descriptions and extracted from the written sources studied. Literature review, as defined by Creswell (2019), is a written synthesis that integrates information from various sources, such as articles, journals, books, and other documents, which presents a description of theory and information, both historical and contemporary. The literature review also involves the process of organizing and classifying those sources into specific topics as well as the supporting documents required in the research Therefore, this framework allows researchers to focus on the research and integrate existing content with information science researchers. (Prof. Dr. Endang Widi Winarni, 2018) (Waruwu, 2024)

Results and Discussion

Result

Definition of TPACK Model

The advancement of various digital technologies that exist today is clear evidence of the development of more advanced technology, and the endless advances in media that increasingly make students interested in a teaching and learning activity. Education has now entered the media era, where all learning activities have increasingly reduced the way speech learning has now been replaced by the use of teaching media tools. Especially when a teaching and learning activity has emphasized skills and active learning, then the media tool for teaching and learning activities will become more important.

Therefore, the world of education needs efforts to improve teachers' ability to apply and implement media to become teachers' competencies in teaching and following technological trends. This framework is known as *Technological Pedagogical Content Knowledge*, a means of supporting the smooth flow of learning. These efforts can improve teachers' competence in teaching and following technological trends. This framework is known as *Technological Pedagogical Content Knowledge*.

TPACK (*Technological Pedagogical Content Knowledge*) is a framework to provide assistance to teachers and educators in applying technology effectively to the learning process. This model illustrates how knowledge of content (subject matter), pedagogy (teaching strategies), and technology must be integrated with each other to create meaningful and relevant learning in the digital age. TPACK is a theoretical framework to integrate technology, pedagogy, and subject matter such as interactive *PowerPoint* to develop students' thematic learning outcomes, especially during the learning process via *zoom/online*. The main components of TPACK include content knowledge, pedagogical(Source, n.d.) *knowledge*, and *technology knowledge*. These three knowledge have contributed to the formation of teachers' TPACK abilities in the integration of technology in the learning process. The following is the definition of the 3 components of tpack:

a. Content knowledge (CK) is the teacher's knowledge of the material or content to be taught. CK involves a deep understanding of concepts, theories, and facts in a particular subject. Teachers must be able to master the content of the lesson thoroughly so that they can convey it correctly to students. (Yulisman et al., 2020)
b. Pedagogical knowledge (PK) is knowledge of effective teaching methods, strategies, and techniques, including how to manage classes, design learning, and evaluate the learning process. Teachers need to understand learning theories and various approaches to create effective learning. In the study, it was found that teachers understand various learning models and methods, but lack specific learning strategies. (Candra et al., 2020)
c. Technology knowledge (TK) is Knowledge about how to use technology effectively to support learning. Teachers must understand relevant technologies, such as educational software or digital *platforms*, to enhance the learning process. Studies in Aceh show that the mastery of kindergarten by science teachers is in the moderate category, which reflects the need for further training. (Saputri & Fatmaliana, n.d.)

TPACK outlines the unified knowledge that comes from each previously introduced knowledge group. It highlights the specific ways in which technology can be designed to meet the teaching needs of delivering specific material in a given situation. Viewed individually, each group of knowledge on which TPACK is based is a crucial and significant part of the teaching process. Teaching effectively is not just a matter of having three basic aspects but more is needed. Teachers who are proficient in TPACK

harmoniously combine knowledge of pedagogical technology and content to provide a meaningful learning experience for students.

Implementation of TPACK in Learning

The application of TPACK in the learning process is a learning activity carried out by teachers to achieve learning goals by integrating technological knowledge, pedagogy, and content into a single unit outlined in the curriculum plan (CLP). The use or application of TPACK in the teaching and learning process is expected to enable teachers to solve learning problems by utilizing digital technology or ICT in teaching and learning activities in the classroom, so as to make learning more meaningful for students. The implementation of TPACK is also a form of increasing teacher capacity, especially in classroom management and following rapid technological developments. The implementation of TPACK will make learning more interactive and independent because technology is a means of learning. (Fajriatul Janah, 2022)

The ability to apply technological pedagogical content knowledge must be applied in every subject, because currently there are no longer restrictions on the use of any method, especially by using independent learning, teachers are free to design the best learning for their students. The use of TPACK in the world of education is expected by teachers when faced with concepts that are difficult for students to understand so that they are easier to understand. Then how to use technology to overcome academic constraints, such as difficult concepts and time constraints. TPACK requires a syntax or steps to be implemented in learning. The following steps are:

a. First, teachers must explain the learning objectives and provide motivation to students so that they are interested in the material. This initial step shows the involvement of *Technology Knowledge* (TK), *Content Knowledge* (CK), and *Pedagogical Knowledge* (PK). When conveying goals, teachers should relate them to the students' daily experiences. This way, learners will feel more motivated because the material learned is relevant to their experience. The use of media such as *PowerPoint* or engaging videos can also increase students' interest. CK helps teachers determine the number of goals that can be conveyed and the learning model used, such as for prayer materials, it is better to use a learning model that involves a lot of practice.
b. The teacher explains the points of the material that will be taught to students, combining *Technology Knowledge* (TK), *Pedagogical Knowledge* (PK), and *Content Knowledge* (CK). At the stage of delivering the material, teachers should associate the introduction with the students' daily experiences. For example, when discussing the values in PAI, the teacher might ask, "Who among you has ever helped your parents at home?" After the students answer, the teacher can relate the experience to the concept of helping in Islam. By using engaging media such as *PowerPoint* or videos, students will be more interested in the material. In addition, CK helps teachers determine the right number of introductions so that students understand the basic material, for example, before

discussing fasting, teachers explain the pillars of Islam so that students have a strong understanding.

c. The teacher starts the learning activity by asking students to group and actively participate. In the third stage, the TPACK, KINDERGARTEN, PK, and CK learning models are applied in the learning process. PK can be implemented in every activity, where each learning step must include elements of pedagogy, materials, and technology. For example, in PAI learning using *the Project Based Learning* (PjBL) model, teachers can start with the planning stage which is carried out through presentations using *PowerPoint*. Here, kindergarten plays an important role when teachers direct students to use technology applications for project planning presentations. Furthermore, at the creation stage, teachers need to utilize PK to manage the class, ensuring that all students contribute to the project. To assess group performance, teachers can apply *peer evaluation* so that students assess each other and are motivated to actively participate. In the *processing stage*, teachers must evaluate whether the project made by students is in accordance with the learning objectives of PAI and ensure that they understand the material being taught. If students still have trouble understanding the material after the project, the teacher should give a reexplanation.
d. Teachers evaluate and reflect on learning activities by integrating three main elements: *Pedagogical Knowledge* (PK), *Content Knowledge* (CK), and *Technology Knowledge* (TK). In the evaluation stage, PK is used to choose the type of evaluation that is appropriate for the material, for example, for the material to know the organs of the body in PAI, the appropriate assessment is psychomotor and cognitive evaluation. After the evaluation, teachers can give students rewards, such as candy or applause, in recognition of their efforts. Kindergarten is implemented using applications such as *Quizizz*, which allows students to work on questions anywhere and anytime, and reduces the possibility of cheating. In compiling evaluations, CK is also important; Teachers must have a good understanding of the material in order to be able to create problems that cover all learning objectives, from low to high levels, as well as measure the cognitive aspects of students. For example, when teaching about morals, teachers can create questions that test knowledge, understanding, and application of moral values in daily life.

Similarly, the use of the internet greatly supports educators in carrying out learning evaluations. Generally, in the evaluation process, a teacher can take two to three days to make improvements to students' learning outcomes. However, with the internet, especially Google Form, teachers only need to share exam links. After that, students will fill in all the questions that have been prepared in Google Form. Once the student finishes answering, the teacher only needs to wait for the calculation of the student's score that has been recorded automatically, and he only needs to move the file.

The Positive Impact of Technology on Students

Digital technology has a role in schools, namely as a means of supporting the vision and mission in order to shape its students into productive and innovative graduates. Because technology can motivate students to want to explore many things. In the era of digitalization, (Rahman Sari, 2021) *technology* has become an integral part of a learning activity process, there are enough students to complain about the difficulty in using technology and the lack of effectiveness of learning if using an online or online system. Because there are those who are constrained by the network, cellphone performance that is not optimal or inadequate technology and many other things that are still problems. The use of technology not only helps facilitate the learning and teaching process but is also useful for the digital era in the future, this is what makes students obliged to learn and understand the use of technology in daily life. If you use technology, teachers can make a learning process more interactive, interesting, and can help students to be able to fill in useful material. Technology used to help the learning process is fun and innovative, for example, problem-based learning processes or case studies. (Khairo & Hairani, 2024)

Almost everyone in society has felt the impact of the advancement of information media and technology, both its benefits and negative sides. Because it can be easily accessed by various ages and social statuses in the younger generation to the old order generation and from the existing to the underprivileged, this is the main reason. Nowadays most children between the ages of five and twelve use technology more than anyone else. It is therefore not surprising that many people say that children between the ages of five and twelve are able to do many things at once, due to advances in technology and information.

Regarding the positive effects of technological developments, we can note the following: 1) It is more convenient and faster to get work done 2) It is possible to communicate with others using email, chat, as well as talk to someone via the internet, which is also called video calling. 3) The emergence of various internet communities to expand new relationships. 4) Provide ease of finding the specific information needed. 5) Provide the possibility that you can shop through the internet. 6) We can do it as well as access the internet at a cheaper rate. 7) Get entertainment activities, such as *online* games and others. Of course, there are many positive and successful impacts, especially associated with education. People can learn quite easily without any reason because they are far away. It is undeniable that schools and universities at this time also use the internet to summarize learning that can be done from home and also children who are nervous about participating in online classes. Technology is used to improve and develop the quality of education. interactive learning tools are one of the efforts to help improve education by applying technology to learning. Technology can be said to be like Library Materials for the main supporting part of the Teaching and Learning process. (Siti Nur Rohmah & Eka Hendi Andriansyah, 2024) (Maritsa et al., 2021)

Based on various studies on Pedagogical Content Knowledge (PCK), this approach is very important in improving the professionalism of teachers and prospective teachers. With technological advancements, the ability to apply technology in learning is needed. Therefore, educators must have an effort in teaching and learning to utilize the TPACK approach so that learning can be integrated with technology. Similar to *Google Classroom*, teachers prepare assignments, learning videos, and short modules so that students can easily access all learning materials.Students can also collect their assignments in *Google Classroom*. *Google Classroom* itself is very capable of attracting students' interest in learning more actively. Due to its simple design, it is very easy to use, and it is also very creative from the learning videos. In addition, in *Quiziz*, teachers give quizzes to students. The quizzes held in *Quiziz* are very interesting for learners to answer the given quizzes. There are scores and rankings and the appearance is very attractive so that students are not bored. (Indah Kuliawati et al., n.d.)

TPACK Utilization Strategies to Change the Mindset of Teachers and Students

Sumaryati defined that the integration of information technology in education aims to improve the quality of learning processes and outcomes. They stated that the use of information technology helps students understand the concepts of civic education through interactive and in-depth methods. Puspitasari explained the integration of technology with the TPACK (Sumaryati et al., 2020) *Technological*, *Pedagogical*, *Content Knowledge*) approach model in the digital era as a framework to combine technology with pedagogy and learning content. This approach helps create teaching methods that are relevant to the needs of today's learners. (Puspitasari et al., 2022) The two opinions of these figures can be used as a benchmark or supporting factor for the government to help improve the quality in every school and even to schools in remote parts of the country. In addition to the equitable distribution of infrastructure for each region, equal distribution of education for each region is also very necessary so that all students get the same rights

Many parents do not agree with the use of technology for their children, so the child is schooled in an education that instills digital zero. In fact, nowadays children have started to use technology in a daily environment. Therefore, the application of technology in the scope of education can help students to learn widely in the use of technology to useful and positive things. Technology can no longer be kept away from children because of the changing times that bring every activity closer to the use of mobile phones, computers, and other advanced tools, therefore it is important to apply technology in the world of education in order to provide a lot of important education and make every child not misuse technology in their lives.

One example of education that does not use technology is traditional Islamic boarding schools and *boarding schools*, students are not accustomed to using technology. So that many students who become graduates of Islamic boarding schools are not very proficient and understand how to use technology. So they only use it as a tool for communication and other basic things.

The implementation of the Technological, Pedagogical, and Content Knowledge (TPACK) approach to the learning process shows that the integration of technological knowledge, pedagogy, and content can increase students' mastery of concepts and learning independence. By integrating kindergarten, PK, and CK into learning, PAI learning will run effectively and efficiently. The emergence of useful and widely used technology in various aspects of life caused by the advancement of science. From traditional or conventional technology to modern digital technology or the industrial era 4.0, these technological advances continue to evolve and penetrate various fields, including business, politics, economics, health, and education. And therefore, teachers must have knowledge and the ability to master technology so that they can increase the creativity and innovation of teachers when teaching, here are some steps that can be taken to develop and have a mindset as a teacher, namely: (Mardhiati, 2023)

a. Learn and keep up with the latest technological developments. Today, the world is changing very quickly due to significant technological advancements. With technological changes that have a big impact on life, education needs to be able to anticipate and adapt. Therefore, it is important for teachers to always keep up with the latest developments in order to be able to deliver learning materials that are in accordance with the needs and stages of student development. In this era, the teaching and learning process can be done online, and teachers can also divide tasks by utilizing technology. Therefore, teachers need to understand how to use technology and how to integrate it in their learning process.
b. Updating knowledge and learning new theories. As educators, it is very important for teachers to adopt new learning methods and understand the needs and characteristics of each student. To become an inspiring teacher, teachers must continue to learn and develop themselves. The principle of lifelong learning, or life-long learning, is the key to success in teaching. As a teacher, the ability to lead discussions during the learning process is essential. Therefore, it is important to learn how to ask interesting questions to make the discussion atmosphere more active.
c. Think creatively and innovatively. Teachers are figures who have the ability to think creatively and innovatively in carrying out their duties. They are instrumental in creating effective and exciting new methods for teaching students. In this case, creative thinking means looking at a problem or situation from various perspectives and being able to come up with solutions. As teachers, they must be able to consider new alternatives and dare to take risks to apply innovative ideas in learning. They are not tied to conventional methods, but are always looking for new ways that can inspire and motivate students.
d. In addition to creative thinking, teachers must also be able to innovate. They can create new methods or approaches that are more effective and fun in learning. They need to keep up with the latest developments in education and utilize technology and other resources to create an engaging and interactive learning experience for students. Teachers also encourage students to think critically, rather than just follow

mechanical procedures, so that they can develop more in-depth and analytical thinking skills.

e. Build good relationships with students. To create a positive learning environment, it is essential to establish a good relationship between teachers and students. Teachers need to build democratic interpersonal relationships with students so that they are more motivated and have better skills in designing learning activities, both individually and in groups. Observations in the field show that teachers who use intelligence to motivate students are more effective than teachers who are authoritarian. Teachers who are able to create an atmosphere of cooperation and mutual respect for the diversity of students tend to be preferred and more successful in carrying out their role as educators. (Moh. Agus Muzakki et al., 2024)

Discussion

TPACK is an integrated understanding of the previously mentioned knowledge set, focusing on the unique ways in which technology can be adapted to meet the pedagogical requirements of teaching specific content in a specific context. Each set of knowledge that makes up TPACK is very important and significant to the teaching process. However, successful teaching involves more than just three elements (kindergarten, PK, and CK). For educators who have TPACK, the combination of pedagogical technology and knowledge *Content* which is used as a material to develop the process of achieving an enriching learning experience for students. (Hardian Tomi, 2023)

As researchers, we argue that the application of TPACK in learning is a synergy between these three components that enriches the quality of teaching. Solid content knowledge will only achieve its purpose if it is delivered in a relevant and enjoyable way through a proper pedagogical approach, which in this case is supported by technology to increase the engagement and effectiveness of the learning process. This integration creates a learning experience that is not only meaningful, but also interactive and in line with the needs of the digital generation.

By using technology, teachers can use existing learning media to create various kinds of creations. Suppose a teacher uses *Canva* to create an interactive module or *Tiktok* to create an interactive video. Not only can teachers keep up with the latest app trends and make lessons engaging for students, but they can also find out about stories that are going viral and connect them with the subject matter to increase students' desire to learn. According to Muhtadi (2019), it is hoped that teachers are obliged to be able to use technology so that learning becomes innovative and creative.

Technology is needed by students, because the times are increasingly advanced and sophisticated, so students must be taught how to process and use technology in depth. Technology will not have a negative impact if students are given a positive education since school. so as not to misuse technology to the wrong things. Therefore, in education, the use of devices that blend with technology must be applied by teachers.

The benefits of the TPACK system can be seen from three positive aspects, including; (a) use learning activities and the selection of learning technologies in a more conscious, varied, and strategic manner; (b) involve learners more in instructional planning, especially cognitive than active student involvement; and (c) resulting in smarter use of educational technology and higher quality standards for technology integration. So that students can understand how to manage and use technology to make things even more useful. Mastery of technological developments at this time is one of the keys so that students are ready to face various challenges that will arise in the future. (Zainuddin et al., 2021)

Limitations

This research requires more information from various sources related to *digital zero* in schools and requires further research to test the application of this model in schools.

Conclusion

This research shows that educators can design more interactive and engaging learning experiences by integrating knowledge of technology, pedagogy, and content. Thus, the application of the TPACK (*Technological Pedagogical Content Knowledge*) model in the context of education has great potential to change the perspective of educators and students on the use of technology in schools, especially in dealing with the phenomenon of "digital zero". The results show that using TPACK not only improves students' understanding of lessons, but also encourages them to use technology more actively while learning. While there are some barriers, such as limited access and the ability to use technology, support from schools and stakeholders is essential to creating an environment that supports the use of technology.

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