

# TPACK LEARNING MODEL DESIGN NEEDS ANALYSIS FOR 21st CENTURY SKILLS

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## ABSTRACT

The aims of this research are 1) to find the current problems and needs for 21st century learning in schools under the North Sumatra Provincial Education Office, Indonesia, 2) to find the need for development and innovation of the TPACK learning model to improve 21st century learning skills. The population used in this study was 252 teachers of State High School and Vocational High School for the 2021/2022 academic year. A sample of 80 people was selected using the cluster purposive sampling technique. The research tool used in this study is a semi-structured questionnaire with 5 Likert scale questions which are divided into 2 parts: general information on respondents in the first part and open questions in the second part asking respondents' suggestions for future educational development. Data were analyzed using descriptive statistics, percentage, mean, and standard deviation. Interpretation is also used in content analysis. The findings in this study are as follows: 1) The skill needs of educators related to the development and innovation of the TPACK-based 21st century learning model are found in 5 aspects, including the skills of preparing, selecting, elaborating, presenting, and evaluating information. 2) From the response of educators as a form of overall behavioral assessment, the level of knowledge and skills of 21st century learning which includes critical thinking, creativity, communication, and collaboration, it was found that there are limitations for educators to change the design of learning from a pedagogic approach to a heutagogic and cybergogic approach related to learning based on TPACK ( $X=65.92$ ,  $S.D. = 8.76$ ); limited skills in selecting, developing and presenting teaching materials from various sources, limited evaluation in the implementation of learning information systems ( $X=76.23$ ,  $S.D. = 7.64$ ); limited studies related to the impact of TPACK-based learning on the quality of learning ( $X=66.74$ ,  $S.D. = 8.26$ ); limited support for teachers and students in implementing TPACK-based learning ( $X=75.65$ ,  $S.D. = 7.87$ ); limited infrastructure and policy support for academic staff in implementing TPACK-based learning ( $X= 78.56$   $S.D. = 8.67$ ).

**Keywords:** Needs analysis, 21st Century Learning, TPACK.

## INTRODUCTION

The challenges of learning in the 21st century are faced with various educational problems in the social, cultural, economic and political aspects related to the problem of globalization which implies the elimination of the barriers of limitations in every dimension of life. The development of technology in the modern era causes remote access to spread in a relatively short time limit. The fundamental problem related to globalization is how the problems of globalization are captured and processed through a positive learning process, especially in the digital era.

The acceleration of technological development has naturally shifted the way of human life to slowly depend on technology. However, integrating

technology in productive activities that have become a habit of being carried out conventionally brings its own problems. Project Tomorrow (2016), a repertoire of IRS-certified non-profit educational organizations in California, United States, reveals that teachers have obstacles and barriers in integrating technology in their daily learning activities. Some teachers have difficulty integrating the technology due to lack of preparation (Cristensen and Knezek, 2017) and lack of guidance (Cocrane, 2010). This preparation can be seen as skill preparation, as well as technical preparation in entering a new work environment.

Teachers may use technology in their daily lives, such as the internet, smartphones and digital cameras, but the use of technology in productive activities or doing assignments is something

completely different (Sun, Strobel, and Newby, 2016). Conceptually Cocrane (2010) explains the gaps that occur in the teacher in the following aspects: 1) the limitations of pedagogic theory related to information technology-assisted learning; 2) limited evaluation in the implementation of learning information systems; 3) the lack of long-term studies related to the impact of information technology-based learning on the quality of learning; 4) limited support for teachers and students in implementing information technology-based learning; and 5) limited infrastructure and policy support for academic staff in implementing information technology-based learning. Thus, Cristensen and Knezek (2017) conclude that there is a knowledge and skill gap in teachers related to the use of information technology-based learning.

The study of Lu and Ramamurthy (2011) indicates that organizational capability in managing information technology will have implications for organizational agility in facing challenges and changes. Furthermore, information technology capabilities that are formed in organizational capacity actually depend on the expertise of individuals or organizational members in managing information technology (See: Kane and Borgatti, 2011; Burton-Jones and Gallivan, 2007; Kang and Santhanam, 2003; Venkatesh, 2000; Chan and Storey, 1996; Davis, 1989; Davis et al., 1989).

On the other hand, based on previous studies, organizational limitations in maneuvering or in receiving and managing information technology to support organizational performance occur at least for four reasons, namely: 1) limited information technology capabilities (Lu and Ramamurthy, 2011; Kane and Borgatti, 2011); 2) limited availability of knowledge (Gray and Durcikova, 2006); 3) poor knowledge management culture (Alavi, Kayworth, and Leidner, 2005); 4) weak IT-Alignment (Tallon and Pinsonneault, 2011).

## RESEARCH PURPOSES

The aims of this study are 1) to find the current problems and needs for 21st century learning in schools under the North Sumatra Provincial Education Office, Indonesia, 2) to find the need for development and innovation of the TPACK learning model to improve 21st century learning skills.

## LITERATURE REVIEW

### 21st Century Task and Learning Characteristics

Technology has long had a role in maximizing learning activities. However, Arends (2006)

reveals that technology will not radically change the format of learning as it replaces full classroom learning. Because face-to-face learning cannot be replaced by information technology (Roehl, A., Reddy, S. L., & Shannon, G. J., 2013; Arends, 2006). Because there is an emotional sensation that should occur in learning activities that make the role of teacher and student interactions remain the main concentration in learning. So the real position of information technology is to strengthen the quality of learning interactions or increase the efficiency and effectiveness of these interactions.

Basically, there are several aspects that may affect the capability of individuals or organizations in managing information technology. Some researchers use the construct of Computer Self-Efficacy in exploring information technology capability variables (Venkatesh and Davis, 1996; Venkatesh, 2000). In addition, information technology skills must be followed by the suitability of its use with the specific work needs of its users. Thus users can take advantage of information technology to increase productivity and quality of performance in their field of work (Kane and Borgatti, 2011; Jasperson et al, 2005; Marcolin et al, 2000). The suitability of information technology and the work environment is often referred to as ICT-alignment by behavioral information systems experts (see: Tallon and Pinsonneault, 2011; Kane and Borgatti, 2011).

If viewed from a psychological point of view, readiness is actually not focused on the technology because technological innovation will still be present and owned by everyone, as stated by Rogers (2010) with the terminology of innovation diffusion. The industry will force the innovations it produces to be absorbed in the market so that there is a diffusion of innovations including information technology innovation (Rogers, 2010). However, how do users respond information technology on the use of information technology becomes the next important issue. The absorption of technology should be directed not only at hedon activities, such as: social media, online shopping, video streaming, and so on, but also must be able to support productive activities (see: Wu and Lu, 2013; Sagala, Zainal, A., & Effiyanti, 2019). Thus academic staff must be able to use information technology in every activity in their academic life, for example in interacting with colleagues and students, providing teaching materials, giving projects, controlling student activities, discussions, assessments, literature searches, and conducting scientific studies (see: Baygin et al., 2016). This comprehensive absorption of course requires the user's mental readiness in dealing with the

technology. This aspect is actually a strategic issue that schools must control in managing the technology attack itself. So that in turn the availability of information technology can be integrated in learning activities appropriately and optimally can improve the quality of learning in schools (Baygin et al., 2016; Sun, Strobel, and Newby, 2016).

### **Learning Model: 21st Century Perspective**

The learning model needed in the future context should be fully integrated with technology and medium rather than technology (Sanghamitra, 2020). Pedagogy in the traditional form where educators speak and students listen is clearly irrelevant. As appropriate, the right learning model is when students explore the truth and are trained to be critical. Transforming the form of physical schools into non-physical schools. Prepare students to be able to respond and develop according to the needs and challenges of the times they face.

Education in the future will use a project-based constructivism learning model and problem solving with a trend approach to community needs. One of them is the use of adaptive learning technology. Innovation and integration of learning style scales should be considered and the open learning model is a new trend in the future (Zhang & Zhang, 2020). Future education is more systemic-organic which emphasizes that the formal education process of the school system must have the following characteristics: 1) Education emphasizes the learning process (learning) rather than teaching (teaching), 2) Education is organized in a flexible structure, 3) Education treats students as individuals who have special and independent characteristics, and 4) Education is a continuous process and constantly interacts with the environment.

Adaptive learning is the same as Intelligent Tutoring Systems (ITS) that use artificial intelligence. Adaptive instruction is training or educational experience adapted to artificial intelligence, tutor-based learning computers with the aim of optimizing learner outcomes (for example, knowledge and skill acquisition, performance, enhanced retention, accelerated learning, or skill transfer from the instructional environment to the work environment (Sottolare, 2018).

The organic-systemic education paradigm demands that education has double tracks. That is, education as a process cannot be separated from the development and dynamics of its society. Adaptive learning is a learning method that prioritizes effectiveness and efficiency. This method suggests

that the teaching-learning process is designed and implemented according to the needs of students, by providing appropriate learning resources. In addition, this method applies a rapid feedback and direction system in teacher-student communication.

Hartley (2001) states: e-learning is a type of teaching and learning that allows the delivery of teaching materials to students using the internet or other computer network media. Learning models that are predicted to complement teaching and learning activities in the future include: Cooperative Learning, Distance Learning, Quantum Learning, Accelerated Learning and E-Learning (Cyber Learning). The learning system is based on the concept of learning through the use of computer/internet-based information technology. Learning technology like this is also called Web-Based Instruction. In the context of the network, e-learning is defined as an effort to connect students/students with learning resources (databases, experts/teachers/lecturers, libraries) that are physically separated and far apart, where interactivity in the relationship is carried out directly or indirectly.

### **A Conceptual Framework for 21st Century Learning.**

In the 21st century, educators must have knowledge as well as skills in using technology tools to facilitate learning and improve learning outcomes. Learning in the 21st century integrates various technological devices in the interaction between students and educators with learning resources. Here technology plays a very important role as a tool, process, as well as a source for carrying out learning.

The use of information technology as a medium in learning is a must in the implementation of learning both remotely and face-to-face. Teaching media is one of the important things in education so it is very crucial to have in teaching and learning activities, (Michel, 2020). The development and management of learning resources is the responsibility of educational organizations at the same time (Piety, 2019). AECT states learning resources as all sources (data, people, and goods) that can be used by students as a separate resource or in combination to facilitate learning and includes messages, people, materials, tools, engineering and environment. Learning resources even turn into components of an instructional system if the learning resources are prestructured, designed and selected and then combined (Khwanying, 2019). Theoretically, media and the development of education are limited and have distinct advantages

(Lucilia, 2020). The collaboration between management and development is well illustrated through the contextualization of the modern era that uses fully digital, (Tariq, 2020).

In its development, technology has processed a lot of data such as Big Data which is categorized as an amalgamation of digital understanding and traces that assemble individual patterns and schemes, (Youngfu, 2019). If used properly, Big Data can provide an in-depth understanding of the patterns and framework of thinking of the students and the subjects being taught.

In modern times and the era of digitalization, a modern educational approach is also needed (Alexander, 2020). The problem that arises is the age gap between the teacher and the students being taught. This is called the intergenerational problem. The solution to this problem can be said to be a complex problem and requires deep thought, especially regarding visuals rather than technology and the precision of using technology.

The problem of the competence of educators in the 21st century is the knowledge of educators that must be mastered to be able to integrate technology well in learning which can be called Technological Pedagogical Content Knowledge (TPACK). In the learning process related to educational technology, educators must be able to equip the ability to design, develop, utilize, use, manage, and evaluate learning using various technologies as processes, tools, and resources in learning.

To develop the competence of 21st century educators, educators must be able to know and master technological knowledge to be able to integrate technology well in learning. With knowledge, TPACK will become a framework that can be used to analyze the knowledge of educators by integrating technology in learning. Management of learning resources is a way to organize a teaching material so that it can be conveyed easily by educators to students. There are many learning resources that can be accessed freely. Several learning resource applications that can be accessed freely. Google scholar, Youtube, Google classroom, Spada, Ipusnas, Emodul.

## RESEARCH METHODS

### Population and Sample

The population used in this study was 252 high school and state vocational high school teachers for the 2021/2022 academic year. A sample of 80 people was selected using the cluster purposive sampling technique.

### Research tools

The research tool used in this study is a semi-structured questionnaire respondents in the first part and open questions in the second part asking respondents' suggestions for future educational development. The semi-structured questionnaire consists of questions asking about knowledge and skills: 1) designing and preparing online learning, 2) selecting and organizing subject matter, 3) elaborating learning stages 4) online information presentation techniques, 5) using applications (software) for 21st century learning needs, and 4) evaluate information. The questions are designed with a 5 Likert scale, ranging from 5 very effective performance, 4 effective performance, 3 moderate performance, 2 limited performance, and 1 very limited performance. The last part of the questionnaire is an open-ended question that asks respondents' suggestions about developing relevant learning models used in the future. The research tool was tested with a reliability of 0.82.

### Data collection

Research data collection was carried out through surveys, and distributing questionnaires to get responses and feedback from 80 samples from 8 (eight) schools divided into groups of SMA and SMK Negeri teachers in 8 (eight) regencies spread across the North Sumatra Province. Respondents are senior teachers who have at least 10 years of working experience and are actively teaching in schools.

### Data analysis

Data were analyzed using descriptive statistics, percentage, mean, and standard deviation. Interpretation is also used in content analysis.

## RESEARCH RESULT

### I. Results

1.1 The skill needs of educators related to the development and innovation of TPACK-based 21st century learning models are found in 5 aspects, including skills to prepare, select, elaborate, present, and evaluate information. The very important needs felt by educators to support 21st century learning in schools are: a) the use of information technology in maximizing learning activities (87.36%); b) the capacity of educators as individuals or organizations in managing information technology in learning (82.62%); c) readiness of educators in organizes integrated learning with TPACK-based information technology (92.28%).

1.2 From the response of educators as a form of overall behavioral assessment, level of knowledge and 21st century learning skills that include critical thinking, creativity, communication, and

collaboration, it was found that there were limitations for educators in elaborating learning steps and changing learning designs from a pedagogic approach to heutagogic and cybergogic approaches related to TPACK-based learning ( $X=65.92$ ,  $S.D. = 8.76$ ); limited skills in selecting, developing and presenting information TPACK material ( $X=75.65$ ,  $S.D. = 7.87$ ); limited infrastructure and policy support for academic staff in implementing TPACK-based learning ( $X=78.56$   $S.D. = 8.67$ ). Discussion Guidelines for promoting TPACK-based science education in relation to effective information technology in all aspects including behavior, skills, and practices of technology adoption in solving 21st century knowledge and learning skills problems that include critical thinking, creativity, communication, and collaboration. Teachers and staff are able to search, collect, use, select, and present information effectively. They also have strong technological knowledge and skills to publish information online and use web-based communication technology to obtain information and enrich course various sources.

Interestingly, this phenomenon also does not escape from primary and secondary education, although the levels may be slightly different. However, schools still cannot avoid integrating information technology both in the administrative aspect and in the application of learning in the classroom. Unfortunately, the real integration of information technology in all learning activities is not an easy matter (see: Sun, Strobel, and Newby, 2016; Schrum, 1999). This relates to the readiness of teachers to organize learning that is integrated with information technology. This is related to how educators elaborate learning steps and change learning designs from a pedagogic approach to a heutagogic and cybergogic approach related to TPACK-based learning.

Therefore, it is very important to provide learning opportunities in professional development for teachers and in training for future teachers (König et al., 2020). Even in (Uerz et al., 2018) new requirements for teachers (students) also demand teacher education. Teacher students and in-service teachers in primary and secondary education need to be educated to use technology as a tool for teaching and to support students' technological literacy (Agyei & Voogt, 2011; Drent & Meelissen, 2008; Sang, Valcke, Van Braak, & Tondelur, 2010; Tondelur et al., 2012). In improving teacher competence in the ICT field, it is not only digital literacy that needs to be trained by teacher educators but more broadly, namely digital competency training as stated in (Falloon, 2020). It

is almost the same that teacher competence increases if the role of ICT is increased in teacher education learning (Blackboard Report, 2009); (Amhag et al., 2019).

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