Journal of Education and Learning (EduLearn)
Vol. 14, No. 3, August 2020, pp. 442~448
ISSN: 2089-9823 DOI: 10.11591/edulearn.v14i3.15946

The technology andragogy work content knowledge model framework on technical and vocational education and training

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Article Info

Article history:

Received Feb 28, 2020
Revised Jun 26, 2020
Accepted Jul 30, 2020

Keywords:

Andragogy learning
Technology learning
TPACK
TVET
Work competences

ABSTRACT

The main competence of 21st century technical and vocational education and training (TVET) teachers is the ability to integrate technology into the learning process effectively. However, the concept of learning is now shifting to technological involvement, learning approaches, and needs in accordance with the curriculum of the world of work must be integrated to produce learning outcomes that are able to compete in obtaining work opportunities. The technological pedagogical content knowledge (TPACK) model used in general learning needs to be assessed according to the context of innovation in the TVET learning field. The purpose of this study is to analyze the teaching and learning of TVET teachers who are professionals with the approach of Technology, Andragogy and Work towards Content Knowledge (CK). Study of qualitative methods in the form of document analysis is identified by the philosophy of the learning approach at TVET and the current TVET learning model. The analysis results recommend that the technology andragogy work content knowledge (TAWOCK) model is considered important to be developed in TVET learning. Characteristics of these findings include the involvement of learning using technology, increasing the level of learning for andragogy, adjusting work competence, and curriculum content developed on the concept of knowledge. Finally TPACK has been modified to TAWOCK to study in the TVET field.

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1. INTRODUCTION

The current technical and vocational education and training (TVET) teacher must be able to create innovations in teaching and learning effectively. The old learning concept slowly began to be abandoned and vocational students assumed that the pattern taught by the TVET teacher had been left behind and was not appropriate in applying it to the world of work. Whereas at present, the presence of the industrial revolution era 4.0 has changed the order of competence in the digital version. These conditions are not simple, and many factors are involved that are heterogeneous such as the generation of teachers in TVET, the completeness of

learning infrastructure, and even the characteristics of students at TVET. So, the ability of teacher adaptation in learning is time to change to a new pattern by involving technology. Thus, the competence of TVET teachers during the learning process is accustomed to integrating technology [1-3].

Technological developments in the learning process have a positive impact, including ease of access, knowledge acceleration, and rapid update of information [4, 5]. Technology-based TVET learning brings better learning conditions in the reception of knowledge [6] and enhances closer relations between teachers and students during the learning process. The researchers believe that knowledge about effective technology in learning is important for 21st century teachers [7, 8]. Technological developments in the context of learning bring changes to the mindset of TVET teachers, especially in explaining information limitations in terms of the ability of new senses or technology implemented in the field of work. The technology knowledge is important to be mastered by TVET teachers and taught to students. The focus of the current study is to integrate technology into the teaching and learning process developed from Mishra & Kohler in general learning [9, 10].

Knowledge of technology is known as the TPACK model concept proposed by Mishra & Kohler in 2006. Until now it has become a reference to learning about technological content knowledge. TPACK was modified from PCK (pedagogical content knowledge) developed by Shulman 1987 [11]. However, better known by the new concept that TPACK has been adopted in various countries and is stated to have a good influence [12-16], including in Indonesia [17-19]. However, researchers analyzed that TPACK was closer to learning in the field of general education. When used in the TVET field, TPACK has not demonstrated specific expertise, although it can be applied. So far there has been no modification of TPACK in TVET learning. Therefore, analysis of related research documents, TVET's learning philosophy, TVET's needs in future work is important to be analyzed and used as reference material for orientation of TVET graduates who are capable of competing. Thus, the research objectives to be achieved are set out in the following questions: (1) what are the characteristics of learning and teaching in the TVET field based on the concept of the TPACK model? And (2) what are the concepts of new learning and teaching models and innovations in the TVET field? The results of this study serve as references and recommendations in the preparation of the curriculum, especially content knowledge that is relevant to the world of work.

2. RESEARCH METHOD

This study evaluated the concept of the TPACK model for learning and teaching in the TVET field. The content knowledge approach is adapted to the context and concepts. The context in question is learning in the TVET field and the concept is adjusted to the objectives and learning in the TVET field. Conceptual models are generated through literature review in the form of responsible references. In this study, the focus of problem solving is based on predetermined research questions. Thus, this research will build on existing theories and evaluate practical problems. The conceptual framework model in this study uses the model from Roel [20], as a framework for research problems, describing phenomena, and analyzing problem structures. The TPACK modification was developed based on the evaluation framework of the TVET content model according to Figure 1.

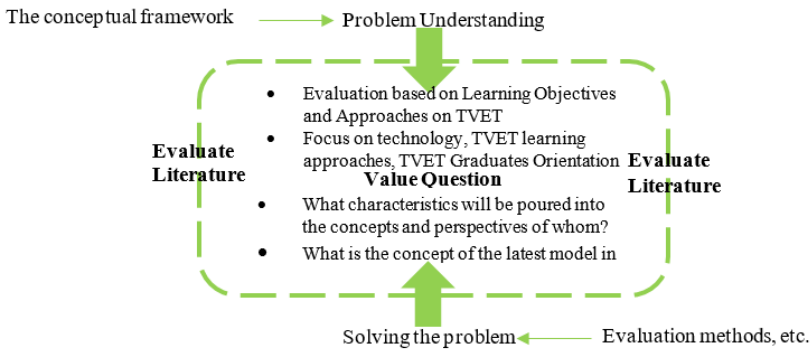

Figure 1. Evaluation of framework model content knowledge for TVET

3. RESULTS AND DISCUSSION

In the field of TVET, especially in Higher Education, TPACK became an interesting discussion. Some opinions contradict TPACK if the concept is applied to the TVET field. Although, so far TPACK has had a positive impact on general education. But TPACK first appeared in learning with technology in science

knowledge with reference to Mishra and Kohler (2006) [10]. The TPACK model concept offers the concept of content learning with the integration of technology and pedagogy. The level of learning approaches will shift at a higher level according to the demands of the 21st century and the challenges of IR 4.0. Thus the level of pedagogy is the basic level [21, 22], which is based on strong theoretical concepts while in TVET learning puts forward the skills. Then, the level of learning will be evaluated more deeply and refer to the objectives of TVET implementation as an orientation towards future work.

3.1. Philosophy, TVET learning characteristics, and future learning

Teaching and learning in the TVET field are adapted to the objectives of results-based education (SKL). TVET is different from general education in its objectives. So that the approaches, strategies and techniques used are not limited to, adoption but must be adjusted or developed. Vocational education is a particular occupation with specific skills. Sudira defines something similar with respect to the nature of work [22]. It is clear that vocational education studies the nature, aspects, paths and levels of work, careers through the development of competencies according to the needs of the workforce. It is clear that the realm of vocational education is education for work.

Education for work requires a learning approach that is able to display one's abilities professionally. A person's skills are reviewed based on their competence. Vocational learning approaches can be made with the Tri-Gogy approach, namely (1) pedagogy, (2) andragogy; (3) heutagogy [24, 25]. Pedagogical approaches emerge in terms of teaching while andragogy and heutagogy emerge in terms of learning that develops based on the broader dynamics of TVET teaching and learning. Teaching emphasizes the role and function of the teacher known as teacher-centered learning while good learning is a student activity in learning.

The TPACK model puts forward the pedagogy, learning approach. Another term engagement level of learning transactions between educators and students. The weakness of this learning approach is the freedom of students to develop mature and independently less efficiently. While TVET 21st century describes learning which leads to maturity of learning [26, 27]. Then the Andragogy approach changes the paradigm of vocational learning as an alternative to efficient learning. [28, 29] Andragogy is known as cultivation, which is the acquisition of competence. Rapid changes in vocational education include life skills, career skills, and learning skills that lead to student independence. Whereas heutagogy has a demand that learning reaches the realization stage and is more than the concept of self-maturity. The level of the learning approach has been explained by Lisa Marie Blaschke 2012 [30], where the higher level indicates the level of student maturity and so does the teacher control needs showing a high level. The levels of student's maturity and teachers control are shown in Figure 2, vocational education needs are more dominant at the andragogy level.

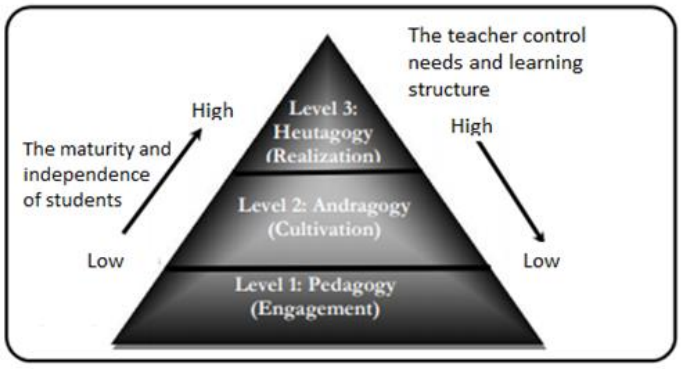

Figure 2. Level of learning approaches between pedagogy, andragogy, heutagogy [30].

Model Concept relies on a pedagogical level learning approach. Whereas the role of technology has shifted the learning needs from pedagogy to the andragogy level, at present. This is influenced by the availability of complex information and TVET's point of view as specific expertise in certain jobs. So the researchers' recommendation is that the pedagogical level learning approach with empirical evidence is currently shifting at the level of andragogy.

3.2. The TPACK model is transformed into the TAWOCK model in the TVET field

The success of science education in teaching and learning is inseparable from the model approach chosen. The TPACK model becomes an alternative as a framework that is able to integrate technological knowledge, pedagogical knowledge, and content knowledge in achieving learning objectives. The concept of this model illustrates how the teacher's understanding of learning technology is integrated with PCK so that learning outcomes are more effective. However, successful learning is seen from various factors, including the characteristics of expertise and students, and it becomes essential for them to reach the expected competence. The researcher describes that TPACK is important in learning science, but needs to be considered in vocational learning.

The previous explanation has been clear that the orientation of vocational education is education for work and approaches to learning maturity and independence. Thus, technological terminology adjusts the context of job specifications. This is where the unique characteristics of vocational education between the fields of expertise have different approaches and understandings of complex competencies. Therefore, the selection of a learning approach model is important to discuss.

TPACK has changed from TPCK [10]. The researchers developed this concept in various educational programs whose aim was to stimulate the teacher in shaping his knowledge by integrating technology, pedagogy and content in an integrated manner. Information and Communication Technology (ICT) education adopted many of these concepts [31, 32]. The following Venn diagram illustrates three domains in TPACK, namely technological knowledge, pedagogical knowledge, and content knowledge. From the primary domains evolved in new domains that are more complex, namely technological content knowledge, pedagogical technology knowledge, pedagogical content knowledge and pedagogical technology and content knowledge. The following Venn diagram adopted from Mishra and Koehler [10], explains the three main domains, as shown in Figure 3.

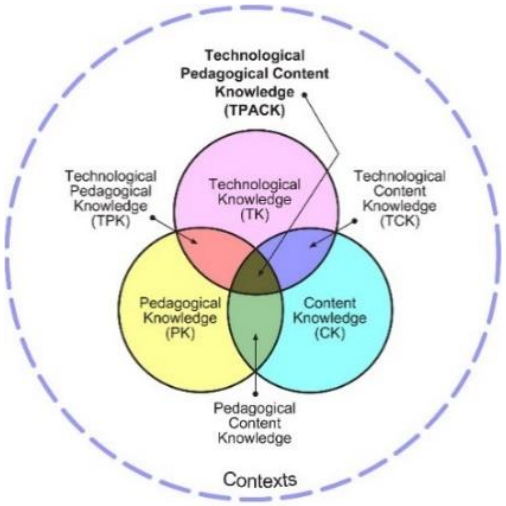

Figure 3. TPACK Model Framework.
The graphic used with permission from http://tpack.org/

The TPACK model is the right choice in learning science [33]. However, researchers argue that this model is not sufficiently specific in the work of a particular field of expertise [34, 35]. Thus a new approach model following vocational education has been offered. The characteristics discussed, consider content knowledge, knowledge and technology, technological knowledge and working knowledge. The change of pedagogical knowledge into knowledge andragogy is influenced by the shift in technology and learning objectives in the vocational field promoting maturity and independence. In addition, content in the form of information in the digitalization era is available in full and fast technology is needed quickly. Work knowledge becomes a new domain that is offered. An important consideration is a need for vocational education to prepare students to master competencies according to their work. Then the concept of TPACK developed into TAWOCK which is used in vocational education. The results of the analysis based on the objectives of specific vocational education are shown in Figure 4, where TPACK (3 Domains) was developed into TAWOCK (4 domains, as follows).

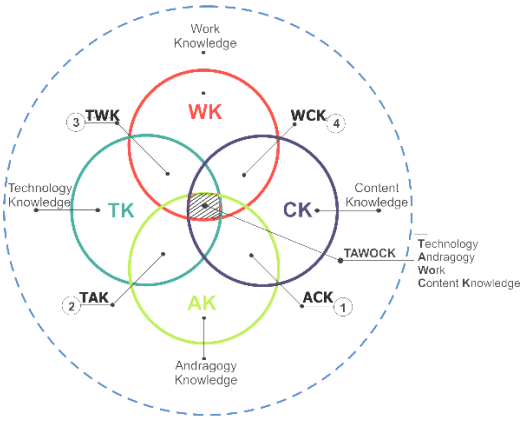

Figure 4. TAWOCK Model Framework on TVET

What are the four domains needed for learning in vocational education, what are the learning content, what technology is used, and what is the job? TAWOCK, as an appropriate learning alternative, makes effective and successful learning in learning in vocational education [36].

a. Technology Knowledge (TK) is how to use technology as a tool to support learning. Technology is the ease of learning in theory and practice.
b. Andragogy Knowledge (AK) is how teachers teach competent-based work-oriented learning material. Learning is used with an adult approach and forms of independence such as PBL, PjBL, constructivism, collaboration.
c. Content Knowledge (CK) is an important point to be learned according to the expert competence unit.
d. Work Knowledge (WK) is the type of work to be taken.

TAWOCK is a framework that has the potential to provide a new direction for vocational teachers in solving problems in technology in learning activities in theory and practice. A total of eight variables were developed, including:

a. Content Knowledge (CK) is the subject matter of knowledge sourced from the educational curriculum into subjects and subject matter content. Vocational education is divided into three groups of subjects namely normative, adaptive and productive. Everything must have content in scrutiny in the field of expertise.
b. Andragogy Knowledge (AK) is the ability to manage learning in theory and practice-oriented to maturity and independence. This is relevant to 21st-century learning.
c. Technology Knowledge (TK) is knowledge about how to use technology in learning needs in theory and practice. In vocational education tools based technology in the discussion of this domain.
d. Work Knowledge (WK) is knowledge of what work is needed and what competencies are needed. The teacher's experience in the job is a determinant of success to be transferred to students.
e. Andragogy Content Knowledge (ACK) is knowledge about how to represent and formulate the subject easily understood by students. Models, methods, strategies, and techniques become ways of packaging learning.
f. Technology Andragogy Knowledge (TAK) is knowledge about technology that can help andragogy such as investigations or inventions in the construction of vocational knowledge.
g. Technology Work Knowledge (TWK) is knowledge about how technology in the workplace is packaged in learning and supports knowledge construction.
h. Work Content Knowledge (WCK) is knowledge about how to work content can be constructed.

Technology Andragogy Work Content Knowledge (TAWOCK) is knowledge of how to facilitate learning to learners of specific skills competencies through andragogy and technology approaches. So that the relationship between variables reinforces each other so it can be seen that significant factors influence teachers in improving the quality of professional learning.

4. CONCLUSION

The choice of concept models in the learning approach needs to be adjusted to the characteristics of the education field. The orientation of the TVET field is education for work. Thus, the concept of needs built is work-based education, maturity and independence. The TPACK model is more appropriate in science

education with a pedagogical approach to children's learning. Whereas TVET requires an andragogy approach to build knowledge, skills and attitudes. In addition, knowledge in the work field becomes its own dominance that must be discussed. This study modifies a new model for learning on content knowledge on TVET, namely TAWOCK.

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