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TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK): THE READINESS OF HIGHER EDUCATION EDUCATORS FACING THE DIGITAL TRANSFORMATION IN TEACHING AND LEARNING

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Abstract

Implementing digital learning systems in Higher Education presents a challenge for educators as they strive to incorporate technology in the educational process in a manner that is active, interactive, and conducive to achieving student learning objectives. The goal of this study is to outline the capability and preparedness of instructors in utilizing digital learning, focusing on the Technological Pedagogical Content Knowledge (TPACK) framework established by Mishra & Koehler (2006). The study, which used a qualitative approach, involved 25 lecturers from the Faculty of Cultural Sciences of a private university as participants. The data was gathered by distributing surveys using Google Forms on the internet. The collected data were then processed and analysed. The output of this research is expected to be an additional reference for TPACK studies at the Higher Education level which can also be an input for the development of lecturer performance in an institution, especially in increasing lecturer competence in digital learning.

Keywords: TPACK; Digital Learning; Competency; Lecturer

INTRODUCTION

The fast advancement of technology has impacted every field, and education is no exception. Nowadays, several universities are implementing a digital or distance class system, especially after the Covid-19 pandemic emergency. Distance or digital learning is a form of learning method that uses an interactive telecommunication system where face-to-face is done virtually because teachers and learners are not in the same room so there is no physical interaction.

The existence of this digital learning system is certainly a challenge for lecturers. Lecturers are required to be able to facilitate an active, effective and interactive teaching and learning process using technology, thus learning goals can still be fulfilled as effectively as possible. In this case, lecturers' competence in integrating technological, pedagogical, and content knowledge (TPACK) in digital-based learning is considered significant.

A private university in Bandung, which is the location of this study, has been implementing a digital learning system since before the Covid-19 pandemic occurred. Thus, at the time of the pandemic, this PTS did not experience significant problems in preparing a distance learning or digital learning system, because the learning management system (LMS) was already available. Up to the time of this research, the percentage of digital learning on this campus is still being implemented for about 60%. This means that the demand for lecturers' competence in incorporating technological, pedagogical, and content knowledge (TPACK) in the online learning is still very high. According to Mishra & Koehler (2006), The understanding of TPACK involves recognizing the intricate connection between technology, pedagogy, and content, enabling educators to formulate effective instructional methods that are in accordance

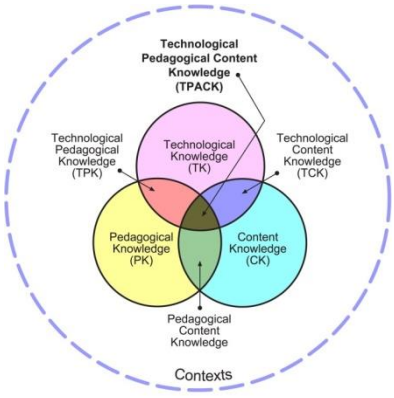
with the specific content of the learner material. TPACK is one of the attempts to improve the standard of the digital learning process which will certainly significantly affect the attainment of learning objectives and student output produced from this College.

Based on this background, this research has the purpose and urgency to explain the competence and readiness of lecturers in one of the Private Universities on digital learning, which refers to the Technological Pedagogical Content Knowledge (TPACK) framework. The expected result of this study is as an additional reference for TPACK studies at the Higher Education level which can also be an input for the development of lecturer performance in an institution, especially in increasing lecturer competence in digital learning.

Technological Pedagogical Content Knowlwdge (TPACK) is considered to be an important element in the current education system which incorporates the increasing demand for the incorporation of technology in online education that does not neglect the pedagogical and content focus. Shulman's (1986) theory of Pedagogical Content Knowledge (PCK) forms the foundation for Mishra and Koehler's (2006) expansion of the theory, which involves incorporating technology into the intersection of Pedagogy and Content within the PCK framework. The pedagogical and content integration represented by PCK involves understanding how certain aspects of subject matter are handled, adjusted, and conveyed for teaching purposes; Mishra and Koehler add technology in consideration that technology has become an integral part of education in 21st century education compared to when PCK was first introduced. As they say, the nature of the classroom has been altered by recent technologies.

However, just as content and pedagogical knowledge used to be regarded as an independent body of information, technology is considered a stand-alone knowledge that has no relationship with content and pedagogical knowledge (Mishra and Koehler, 2006). The development of the TPACK framework aimed to highlight the connections, interactions, aadvantages, and limitations among content, pedagogy, and technology. The picture is illustrated as follows.

Figure 1. TPACK Frameworks



Practically, this framework emphasises the importance of seeing knowledge as one integral part and not seeing it in isolation.

Basically, according to Mishra and Koehler (2006), there are seven elements and relationships of the TPACK framework, namely: 1) technological knowledge; 2) pedagogical knowledge; 3) content knowledge; 4) technological pedagogical knowledge; 5) technological content knowledge; 6) content pedagogical knowledge; and finally 7) technological pedagogical content knowledge. Each of these elements will be outlined below.

The lecturer's understanding of both traditional and modern technologies that can be incorporated into the curriculum is referred to as Technological Knowledge (TK). Understanding Technological Pedagogical Knowledge (TPK) involves knowing how

technology can constrain and enable specific pedagogical methods. The understanding of Technological Content Knowledge (TCK) entails the understanding of how technology and content influence each other. The intricate connection of technology, pedagogy, and content is known as Technological Pedagogical Content Knowledge (TPACK). With this knowledge, educators can create appropriate and contextual teaching methods.

Knowledge of content (CK) refers to understanding the actual material that needs to be delivered. Pedagogical knowledge (PK) involves a deep understanding of the methods and practices of teaching and learning, including their broader goals, values, and purposes within education. Pedagogical Content Knowledge (PCK) integrates CK and PK to understand how specific topics, issues, or problems are organized, presented, and adjusted to accommodate a range of student demands and skill levels.

The practical development of TPACK was also carried out by Jaipal-Jamani & Figgs in 2014. They developed three components, specifically: 1) Practical implementation of TPCK; 2) Practical implementation of TCK; and 3) Practical implementation of TPK. Practical implementation of TPCK focuses on the knowledge of how to develop technologically enhanced learning environments for various teaching modalities in order to meet the learning objectives of the content being taught. Additionally, practical implementation of TCK stresses the importance of content-appropriate technology-related knowledge and the ability to use these tools effectively across different disciplines, as well as the lecturer's own competence in using these tools. Finally, TPK-in-practice is primarily concerned with knowledge related to practical teaching competencies required to plan and execute technology-enhanced learning experiences.

TPACK, especially in language learning, has been the subject of numerous investigations. In 2020, Tseng, Chai, Tan, and Park (2020) identified 51 articles that examined TPACK in terms of its exploration, development, and implementation. Research related to TPACK was conducted in both non-formal and formal education settings.

In non-formal education, TPACK-related research was conducted by Rahmadina, et.al (2022) in a private English learning institution in Bandung. This research focuses on exploring how TPACK affects the way instructors make decisions and supervise students in digital learning.

In the scope of formal education, especially higher education, a study in Malaysia focused on the TPACK readiness of English Lecturers with regard to the adoption of digital/online learning or called Open Distance Learning (ODL) in a Malaysian State University. The research conducted by Aziz, et.al (2022) showed that the lecturers' TPACK readiness was progressive and relatively able to overcome the barriers in Open Distance Learning (ODL).

In the same year, TPACK research was conducted in Spain by Abia, et al (2022). The impact of the mandatory changes in teaching due to Covid-19 on quantitative subjects was examined in this research, considering the TPACK model's educational, technological, and content related elements in Spain. The findings indicated that students with traditional learning preferences gave favorable evaluations of the techniques and resources employed based on the surveys conducted.

Not only abroad, TPACK-related research has also been conducted in Indonesia. Firstly, a study focusing on the implementation of TPACK in teaching writing courses was conducted by AlFirdaus & Yuwono (2019). The research, which was conducted at a private university in Indonesia, concluded how the TPACK of writing course lecturers affects the way the material is taught, which can be seen from the ability to prepare learning tools such as Semester Learning Plans (RPS) and Learning Implementation Plans (RPP) that will be applied in class.

Another study conducted by Ayuna, et al (2022) explored the influence of TPACK and ICT equipment completeness on the performance of a private university. In addition, there is also research conducted by Albetaet, et al (2023) which looks at the educational philosophy behind new trends and problems with TPACK and blended learning. Lastly, the research carried out

by Bahtiar et al (2023) examines TPACK research patterns in scientific education for the 21st-century as determined by TPACK documents analysis, journals ranking, authors and their countries of origin classification, and the keywords categorization.

METHOD

This study was conducted as an effort to identify and describe the readiness of lecturers' competencies with regard to technological, pedagogical, content or material knowledge (TPACK) in digital learning at universities in Bandung. This study employs a qualitative method with a descriptive study serving as the foundation. Qualitative research that focuses on specific phenomena does not lack generalisability and comparability, but has internal validity and contextual understanding (Alwasilah, 2000). This research focuses on describing the phenomenon of lecturers' competency readiness pertaining to technological, pedagogical, content or material knowledge (TPACK) in digital learning at universities in Bandung. Thus, the descriptive qualitative method is considered appropriate for this research.

This study was implemented at a private university in Bandung City involving 25 lecturers from the Faculty of Cultural Sciences with diverse demographic backgrounds (age, position, functional position, and years of teaching experience). A Google Forms questionnaire form that was modified from one created by Schmidt et al. (2009) was used to gather the data for this investigation.The questionnaire, which had been modified according to the needs of this study, was then distributed online. The questionnaire was divided into several sections, namely: 1) personal data information as background information of participants; 2) technological knowledge (TK); 3) content knowledge (CK); 4) pedagogical knowledge (PK); 5) pedagogical content knowledge (PCK); 6) technological content knowledge (TCK); 7) technological pedagogical knowledge (TPK); and 8) technological pedagogical content knowledge (TPACK). The self-efficacy constructs of the aforementioned TPACK components were measured using 5-point Likert scaled items in this data collection procedure. A 5-point rating system was used to categorize the items: 1 represented severely disagree, 2 disagree, 3 neutral, 4 agree, and 5 represents highly agree. These items were created with the idea that self-efficacy was a skill within the context of "can do" claims.

In addition to the questionnaire, interviews were also conducted to be able to explore deeper information that was not obtained from the questionnaire data. Interviews were conducted on several randomly selected participants to add to the explanation of the data. Interviews are an effective instrument for obtaining in-depth information from respondents (Alwasilah, 2000). This can occur due to several possibilities that allow the interviewer to confirm previously obtained data and ask follow-up questions to the interviewee so that the interviewee can obtain clearer information and clearer information and better understanding. In addition, historical information can be provided by the interviewee during the interview (Alwasilah, 2000; Cresswell, 2000). Thus, in-depth information can be obtained properly.

The data obtained from the questionnaire was then classified and analysed using the TPACK theoretical framework developed by (Mishra & Koehler, 2006). Meanwhile, the data obtained from the interviews were processed into several stages, namely, first transcribed, second classified, and finally analysed using the TPACK framework used in this study, namely TPACK developed by (Mishra & Koehler, 2006), in line with the analysis of data from the questionnaire.

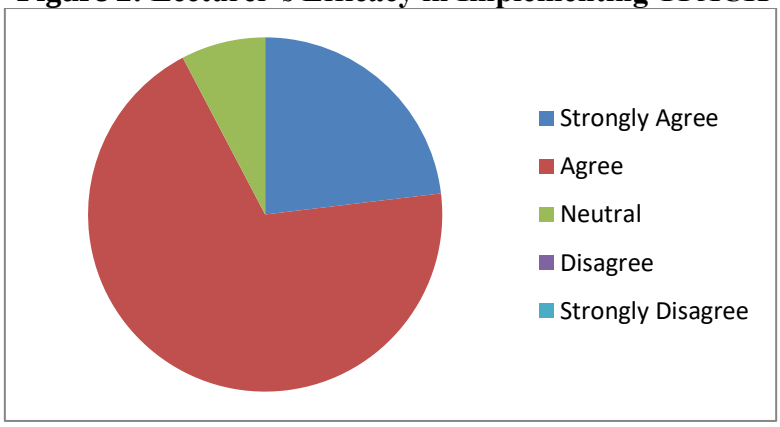
RESULTS AND DISCUSSION

Results

Based on the data analysis, it was found that in general, the readiness and competence of

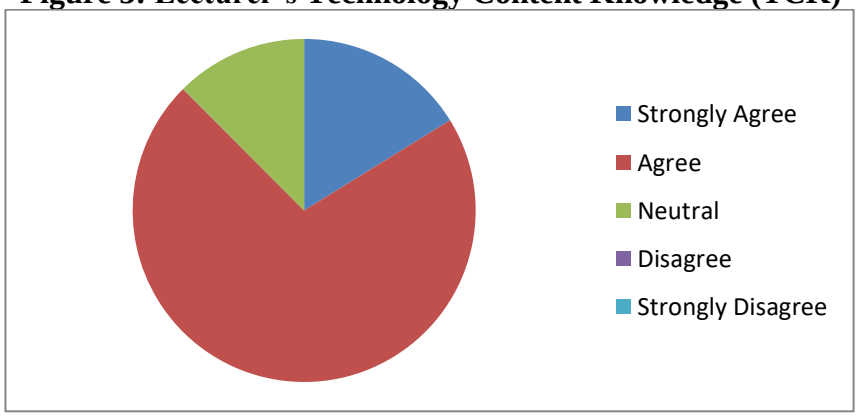
lecturers related to TPACK in digital learning is quite good. This is evidenced by the percentage of data as illustrated in the following diagram:

Figure 2: Lecturer's Efficacy in Implementing TPACK



The preceding graph indicates that the vast majority of participants showed a positive response to their self-efficacy in implementing TPACK in the classroom. A total of 69.2% of participants agreed and 23.1% of participants strongly agreed that they can teach by combining content knowledge, technology, and teaching approaches or pedagogy in the classroom.
Based on the data analysis, the readiness and competence of lecturers in implementing TPACK in the classroom can be seen from several things, namely: 1) the consideration of technology adjustment with the content of the material to be delivered; 2) the consideration of technology adjustment with the character of students in the classroom; and 3) the consideration of technology adjustment with the stages of learning in the classroom. The implementation of TPACK itself is delivered by participants to help achieve learning objectives more effectively and optimally.
1. Consideration of Technology Adaptation to Material Content
The readiness and competence of lecturers in implementing TPACK in the classroom is shown by the consideration of technology adjustment with the content of the material to be taught. This data shows that lecturers already have "technology knowledge", "content knowledge", and "technology content knowledge" as evidenced by the large percentage of positive understanding and mastery of technology and their field of expertise. In the context of technology content knowledge (TCK), 23.1% of respondents strongly agreed, 57.7% agreed, and the other 23.1% were neutral on statements related to knowledge and understanding of technology in accordance with the content of the material to be taught as illustrated below.

Figure 3: Lecturer's Technology Content Knowledge (TCK)



This data is also supported by data obtained through interviews. In the interviews conducted,

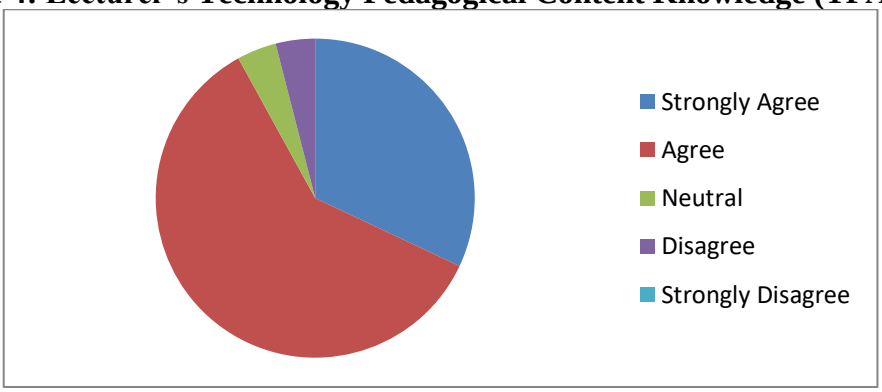
participants stated that there was a consideration of the selection of technology used in accordance with the material to be taught. For example, the selection of YouTube videos for teaching linguistics, the use of orai application for teaching speaking. In this case, lecturers really need to choose technology that can facilitate the delivery of material so that learning objectives can be achieved more effectively.

The TCK identified above is in line with the theory presented by Jaipal-Jamani & Figgs (2014) which states that TCK-in-practice refers to lecturers' knowledge related to technology that is appropriate to the content (understanding of the decvices of a discipline) and their capacity to use the technology appropriately.

2. Consideration of Technology Adjustment with Student Character and Classroom Learning Methodology

The mastery of the TPACK component of the participant lecturers is also indicated by the consideration of technology that is adjusted to the students' character and learning activities in the classroom. This means that the participants have a comprehension of the integration of technology and pedagogy (TPK). On the questionnaire point stating the respondents' ability to adjust their teaching style to learners with various characters and different ability levels, 92% showed a positive response agreeing with the statement as illustrated in the following diagram.

Figure 4: Lecturer's Technology Pedagogical Content Knowledge (TPACK)



The data above indicates that the most of participants adapt their teaching approaches, styles or techniques to the diverse characters and ability levels of the students. This may include essential aspects such as materials, media including technology, direction of communication, and assignments. This means that the participants know and have applied pedagogic knowledge.

In addition to being indicated by the majority of positive percentages on the TPK question points in the questionnaire, in the interview session, participants also stated that at the lesson planning stage, consideration of technology selection was also adjusted to facilitate differences in student characters and learning styles as much as possible. For example, by using power points that can help students get a visual picture of the material taught so that they can understand better, or the use of videos that not only show visuals but also audio, including the use of quizzes and/or games that can facilitate students to understand the material better by repeating or doing something.

In this case, the stages of learning are also taken into account when using technology. An example obtained from the interview is the difference in technology for warm-up activities, presentations, and also exercises or practices. Thus, it can be concluded that this is in line with the technological pedagogical knowledge (TPK) in practice conveyed by Jaipal-Jamani & Figgs (2014) and Shulman & Koehler (2006), that lecturers have practical teaching competence so that they can plan and implement technology-enhanced learning.

3. Obstacles Anticipation

There are always challenges when it comes to using technology in the classroom. According to information gathered from questionnaires and interviews, the challenges encountered in the classroom are typically more technical in nature. However, so far the respondents stated that these technical obstacles can be anticipated by the existence of several plans made before the implementation of learning activities or spontaneously done when obstacles occur.
To increase their own skills in using technology, especially in teaching and learning activities, the participants attended professional training, learnt from other friends, or learnt to tinker with the technology themselves. In this case, the data shows that lecturers with a younger age tend to be more exploratory and experimental in trying and using various applications or the latest technology in the classroom compared to lecturers with a more senior age. However, basically, the average participating lecturer has an understanding and mastery of the integration of technology, pedagogy, and content in the classroom regardless of the types of technology used.

Discussion

Despite having varying levels of TPACK competency, it is possible to draw the conclusion from the aforementioned results that the lecturers in this study were generally aware of technological integration into the process of teaching and learning. In this instance, practically every lecturer used technology in the classroom to support the interactive, dynamic, and complete learning process that was encouraged during instruction. It was identical to the research done in 2021 by Yatun, Munir, A., and Retnaningdyah, P., which disclosed the incorporation of a number of technological tools.
Hence, the the lecturers were also aware that integrating technology in the classroom should be equipped not only with the sufficient knowledge about the selected technology and how to operate it, but also with the sufficient knowledge about the content or learning materials and how to teach them appropriately so that the learning objectives could be obtained optimally. Thus, it was significant for the lecturers to have Technological Pedagogical Content knowledge (TPACK). Carrillo, et.al. (2020) stated that there was a need for a comprehensive understanding of the pedagogy for online learning that utilized technology as the aid of teaching and learning, as digital learning practices were not only about cognitive aspect, but also social aspect. In the practices, the lecturers usually planned the details of what and how to teach as well as the media, including technology used before the teaching learning process to make it well prepared and well managed. It was in line with Al Firdaus, M.M., Yuwono, A (2019) who stated that the way of a lecturer's teaching could be observed from his competence in arranging the lesson plan.
Technological Pedagogical Content Knowledge (TPACK) was highlighted as an essential competence that helped improve the standard of instruction during the learning process. Garindo, et.al (2022) said that the digital learning with TPACK encouraged participation and follow up. It was the same as the findings that revealed students' centre promotion when the lecturers integrated TPACK in teaching learning process. In this sense, the lecturers did not do spoon feeding but acted as facilitator, controller, and motivator. It was in accordance with Septiyanti, et.al. (2020) who found that by TPACK, lecturers assist the students' learning by becoming a provider, a role model, a controller, a facilitator, as well as a motivator.
Apart from that, it was found that there was a slightly difference of competences possessed by the lecturers. The senior lecturers aged 40 years old above tended to have better pedagogical and content knowledge. On the other hand, the lecturers under 40 years old had tendency to have better technological and content knowledge. This finding was the same as the study conducted by Akun, J.C.A., Mohamd, F.S.(2020) that those with more experiences in teaching

were more confident of their CK,PK, and PCK while the new ones reported to have higher confidence in TK. Nevertheless, the whole participants approved the need of professional development particularly in terms of TPACK that was indicated to be obtained through various ways, such as by joining the seminar, reading books, learning from peers and even from online media such as youtube. The same finding was revealed by Kirana, G.D & Nabhan, S (2021). The professional development in any ways help the lecturers to integrate TPACK better in the practices. As found by Janssen & Lazonder (2019) and santos, J.M & Castro, R (2021), the pre-service teachers who received related integrated support performed the teaching learning process better.

In addition, another important element in the integrationof TPACK was the provision of facilities and equipment. The lecturers' TPACK competence would not run as expected without any sufficient faculities and equipment needed. Ayuna N. E., Santosa P. Pramiarsih E. E., & Ginting A. (2022) stated that facilities had an impact on TPACK, TPACK had a positive impact on competitive advantage which led to the Higher Education's Performance.

CONCLUSION

The demand for the use of technology in this digital era has indirectly forced lecturers to be able to adapt to implement technological pedagogical content knowledge (TPACK) in the classroom. Based on the data obtained, the participants in this study have sufficient readiness and competence to integrate understanding and mastery of content and pedagogy with the use of technology. This means that lecturers have been able to implement the delivery of learning materials with appropriate teaching approaches that are reinforced by technology. This is also recognised by participants as helping students to effectively achieve learning objectives.

Despite the differences in the number of technologies commonly explored and used in the classroom, the participants endeavoured to improve their competence in the use of these technologies in the classroom. Based on the data, the lecturers showed enthusiasm in improving their professional competence. This study has limitations in data collection and time of research implementation, however, from the existing data, it is suggested that related institutions can organise trainings that can improve lecturers' competence, especially in the implementation of TPACK.

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