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Assessing undergraduate students' perspectives on lecturers' technology, pedagogy, and content knowledge competency

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Abstract

Educators' knowledge of technology is necessary for the learning process to better assist the students' understanding. One of the efforts made to improve their understanding is using technology-based learning. This study aims to evaluate the undergraduate students' perception of their lecturers' Technology, Pedagogy, and Content Knowledge (TPACK) and the process students acquire TPACK for learning. This study was conducted in a survey research type. The population was 190 undergraduate students, but the purposive sampling technique resulted in a total of respondents of 60 students. TPACK competence scale was used for data collection. The findings indicated that the student's perception of their lecturers' TPACK competence was in an excellence category, as seen from overall domains' scores of 89.73. Students gained TPACK by observing lecturers teach and self-studying using the internet. This study suggests that lecturers could improve their teaching quality in language teaching by implementing technology as a medium.

Keywords: Language learning, TPACK, undergraduate perceptions, lecturer competency, teaching quality.

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1. Introduction

In the Era Society 5.0, technology, communication, and information are indispensable for learning. Learning requirements emphasize fostering students' creativity, innovation, productivity, adaptability, and competitiveness. Following the learning requirements of Era Society 5.0, teachers can leverage technology advancements to help students become more proficient in understanding lesson content (Susilawati et al., 2021).

The teaching and learning process evolves in tandem with the advancement and development of society. Learning should be adjusted to the current growth in this modern era (Fitriyadi, 2013). Learning methods, approaches, and learning material usage are all important. In this instance, it is desired that teachers continue to build their professional competencies during this expanding period. Teachers should constantly innovate in various ways while implementing professional competence development, especially in terms of the teachers' competence, so that it has a beneficial impact on teaching (Djatmiko, 2016; Serdyukov, 2017).

Technology and information are continually evolving, significantly impacting education (Chauhan, 2016; Mcnicholl et al., 2019; Stone, 2016; Zajda, 2015). In today's world, integrating technology into the learning process should be applied to adapt to the challenges of the 4.0 revolutionary industry. Teachers must use technology to improve teaching quality (Gherhes et al., 2021). In this case, the students are exposed to technological development. They see it as more than simply a teaching tool but a tool to assist them in learning.

1.1. Conceptual or theoretical framework

Integrating technology into learning in a meaningful way is challenging, particularly for educators. A teacher must have a thorough understanding of the content or subject material in order to choose the appropriate technology for teaching. Teachers must also choose teaching strategies appropriate for the technology employed, which requires pedagogical understanding. Therefore, it can be stated that a teacher must possess an understanding of learning material content, pedagogy, and technology in order to integrate technology effectively (Sholihah et al., 2016). These three knowledges interact to generate Technological Pedagogical Content Knowledge (Mishra & Koehler, 2008).

Educators' ability to implement technology into the class can be observed through teachers' Technology, Pedagogy, and Content Knowledge (TPACK) (Santos & Castro, 2021). TPACK framework for educators' knowledge is defined as a complex relationship between three types of knowledge, namely technology, pedagogy, and content, plus the relationships among and between them (Koehler et al., 2013). As stated by Akhwani and Rahayu (2021), there is no certainty that teachers' material knowledge is proportional to their pedagogical and technological competencies. A teacher may be intellectually competent but lacks teaching and technical knowledge. In addition, it is uncertain if teachers who possess material knowledge and a high level of pedagogical expertise also possess expertise in technology.

There are three core components in TPACK: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). In addition, the four integrated components in TPACK are Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Content Knowledge (TPCK) (Rosenberg & Koehler, 2015; Valtonen et al., 2015).

TPACK is critical for the education system, especially for teachers, since they are the educators who build a new generation. Many studies have indicated that TPACK deployment in the classroom still

requires attention to achieve successful learning. The TPACK framework is vital for analyzing the self-efficacy views of educators and considering professional development opportunities connected to the effective integration of technology in the class. However, only a small amount of attention has been dedicated to actual teaching practice (Saudelli & Ciampa, 2014).

1.2. Related research

Previous research on TPACK in the education field has different findings. Intan et al. (2019) found that teachers' TPACK competencies influence students' learning environments, specifically when the teachers had pedagogy and were facilitated by technology. In addition, Lavidas and Angeliki (2021) showed that preschool teachers had sufficient perceived self-efficacy for integrating ICT (Information and Communications Technology) in all TPACK domains. Krause et al. (2018) also reported that TPACK has a wide range of experiences in education and faculty modeling of technology, as well as technology incorporation into field trips. Meanwhile, Koyuncuoğlu (2021) stated that students' TPACK competence could differ based on gender, level of education, and field. They showed that doctoral students had a higher perception of knowledge and competence in the TPACK scale dimensions. Then, to overcome the gap, this current study aims to evaluate the lecturers' TPACK competence and how the students acquire TPACK in learning based on the student's point of view.

1.3. Purpose of the study

This study aims to determine whether lecturers could apply TPACK. Additionally, this research investigates how students perceive teachers' abilities to apply technology in the learning process. This study's results are expected to provide beneficial information for educators, researchers, and students about the significance of improving lecturer competence with technology. The lecturers with good TPACK competence are anticipated to develop TPACK professional development opportunities, leading to more successful technology integration.

2. Method

2.1. Participants

This research was carried out using a mixed method, namely qualitative and quantitative approaches. The population of this study was 190 students of the Indonesian Language Education Program at Asahan University, Academic Year 2021/2022. Then, 60 students were chosen as a sample using the purposive sampling technique.

2.2. Data collection tools

A questionnaire and a guided interview were used as the instrument in this research. The questionnaire was adapted from Tseng (2014) (see Appendix). The questionnaire was used to get the students' perceptions about their lecturer's TPACK competence, which consists of seven sub-domains of TPACK: TK, PK, CK, TPK, TCK, PCK, and TPCK (see Table 1 for abbreviation).

Table 1

Domains Abbreviation

Abbreviation	Domains
TK	Technological Knowledge
PK	Pedagogical Knowledge
CK	Content Knowledge
TPK	Technological Pedagogical Knowledge
TCK	Technological Content Knowledge
PCK	Pedagogical Content Knowledge
TPCK	Technological Pedagogical Content Knowledge

The questionnaire was distributed in the form of *Google Forms*. Before distributing the questionnaire to the students, an expert validated the questionnaire to evaluate the content and language use. The questionnaire was organized in the form of close-ended statements. The multiple-choice questions allowed the students to choose their answers from several options that fit them (Frankael et al., 2012). The instruction is that the students should tick the degree of agreement according to the Likert scale, namely strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1), as suggested by Sugiyono (2008).

2.3. Data collection process

For data collection, 60 students from the fifth semester participated in completing the questionnaire. Twenty-five students were selected using the random sampling technique for the interview stage. Then, the researcher interviewed them to support the first data. This interview was performed after distributing the questionnaire. The interview determined how the students obtained TPACK in the learning process. The researcher recorded, transcribed, and analyzed the interview results to answer the questions related to how students obtained their TPACK in the learning process.

2.4. Data analysis

The scores of the questionnaire are grouped based on domain and then summed. The final score for each domain is calculated using the following equation:

$$Final\ score = \frac{Total\ score}{Maximum\ score} x100$$

The maximum score is the total score if all respondents choose the strongly agree option (score = 5). Since each domain contributes 5 items, the maximum score for each domain is 1500 (note: with a total of 60 respondents).

The obtained score is then classified by the following criteria: (1) A score $\geq$ 85 is considered as excellence; (2) 70 $\leq$ score < 85 is categorized as good; (3) 55 $\leq$ score < 70 is categorized as fair; (4) 40 $\leq$ score < 55 is categorized as poor; and (5) a score < 40 is categorized as poor.

3. Results

As previously stated, the Likert scale applied in this research examined seven domains of TPACK. The mean scores are provided in Table 2. The following sections explain the analysis results for each domain.

Table 2

Mean Score of Seven Domains

Domains	Score	Category
TK	91.59	Excellence
PK	90.89	Excellence
CK	84.12	Good
TPK	91.83	Excellence
TCK	89.57	Excellence
PCK	88.95	Excellence
TPCK	91.13	Excellence
Total	89.73	Excellence

3.1. Technological Knowledge (TK)

TK relates to the lecturer's knowledge of new or digital technology, e.g., the internet, smartphones, computers, laptops, and software programs. There were five items to which students had given responses. The finding indicates the score on the TK domain of 91.59, which can be considered excellent.

Students perceived that the lecturers knew the software and hardware of necessary computer devices. Lecturers also learn how to solve the two devices' technical problems, such as using a webcam, setting up a printer, installing drivers, setting up WiFi connections, and uploading files in the Cloud. The lecturers keep up with the latest significant technological developments, such as using *Zoom Meeting* during online classes and encouraging students to actively create student papers that can be published on Facebook and other online sites.

3.2. Pedagogical Knowledge (PK)

PK reflects the lecturers' grasp of methods and strategies used to organize courses, manage classrooms, and assess students' learning. There were five questions to which students responded. The score on the PK domain is 90.89, which is considered an excellent category.

Based on the student's responses, they perceived that the lecturers use a variety of teaching strategies and evaluation techniques in the classroom. This helps the students feel comfortable during the teaching and learning process. Lecturers actively gave feedback to the students on their performance, knew how to manage the class, and developed good relationships with students.

3.3. Content Knowledge (CK)

CK is the teachers' understanding of the content taught in class. There were five items that the students had fulfilled. The result reveals that CK domain has a score of 84.12 (good). From the questionnaire results on CK from the lecturers, most of the students' perceptions showed that the lecturers knew the teaching content deeply and explained it in easy-to-understand language by providing relevant examples.

3.4. Technological Pedagogical Knowledge (TPK)

TPK is the educators' awareness of using certain educational practices to fit affordance technologies. The score in this domain is 91.83 (excellence). From the questionnaire result, the students' perceived that by using technology, most lecturers motivate students to learn, explain the material clearly, interact more with them, facilitate teaching activities, and be able to choose which technology to transfer the knowledge.

3.5. Technological Content Knowledge (TCK)

TCK is educators' knowledge of how subject matter is conveyed through various technologies. The result shows that the score for this domain is 89.57 (excellence). From the questionnaire on the TCK domain, most of the students' perceptions revealed that the lecturer uses digital teaching materials to help the students read, speak, and learn the material better.

3.6. Pedagogical Content Knowledge (PCK)

This domain is focused on teachers' knowledge of how to apply instructional strategies to present the material, reduce learner difficulties, and enhance students' comprehension. The result indicates that the score for PCK domain is 88.95 (excellence). From the questionnaire on the PCK domain, most students' perceptions revealed that the lecturer organizes some activities that can help the students practice and appreciate learning better.

3.7. Technological Pedagogical Content Knowledge (TPCK)

TPCK emphasizes teachers' attention to the dynamic, transactional connections between the three components of knowledge. The result shows that the score for TPCK domain is 91.13 (excellence). From the questionnaire on the TPCK domain, most students' perceptions revealed that the lecturer could present content with the right strategy through various technology and teach the material using computers to help the students learn better than before.

4. Discussion

Based on the results, students positively perceived TPACK. It implies that the students believe the lecturers can integrate technology on content and pedagogical subjects in learning the Indonesian Language. The average score of lecturers' TPACK competence is slightly different. Based on the questionnaire using the Likert scale, the highest mean score was in the TPK domain (91.83). Then, it was followed by the TK (91.59), TPCK (91.13), PK (90.89), TCK (89.57), PCK (88.95), and CK (84.12) domains. All domains got an excellent category, and only CK got a good category. In addition, the overall mean score of all domains was 89.73, which falls in an excellent category.

TPK relates to understanding how numerous technologies can be implemented in the class and the prospect for technology to reshape the teaching style (Schmidt et al., 2009). Teachers must apply pedagogical knowledge of technology in the classroom to ease various pedagogical strategies, such as distinguishing and managing the class, as well as leading students to organize their learning (Heitink et al., 2017). Based on the results, lecturers can apply several technologies that can help the learning process in the class, ensuring that learning occurs effectively and students can grasp teachings quickly.

Furthermore, students' TPK was higher than TCK because most students are in the second and third years of learning (4th and 6th semester). They had mastered teaching topics and completed university qualifications, such as micro-teaching, material development, lesson plan, and language teaching method. It could be considered that students like to learn through technology. They were motivated and curious about the learning material when the lecturers introduced technology that could be used to obtain the information they needed to know. In addition, based on the interview results of the students, they claimed to constantly use technology to find subject-related learning materials, such as writing scientific papers and reading through free e-books on the internet, regardless of their professors' instructions. The students agreed that they had easy access to technology for learning purposes since they had the resources to aid their education both on campus and at home.

Additionally, the lowest score of all domains was CK. Although this domain got the lowest percentage, it still indicated that the students had a positive perspective with a good category. CK was the poorest because the students' perceived that their lecturer asked them to study independently to explore the material, explained the material briefly and not give many examples, and delivered the material monotonously. In other words, even though the lecturer still has certain flaws based on students' perspectives, the lecturer's content knowledge can still be classified as good. Gamayao and Binas (2021) stated that teachers' competence in subject matters provides appropriate methods and strategies for learning, which indicates that the teachers are knowledgeable.

This study's findings contradict those of Suyamto et al. (2020), which indicate that CK has the highest score in their study. This is related to the varying levels of education of the research participants. Suyamto et al. (2020) involved high school students in their study. Meanwhile, this current study is participated by undergraduate students. This is evident since disparities in educational levels have an impact on learning content. Undergraduate students have greater freedom to study related content. In contrast, high school students rely on the teacher to provide the material.

Based on the data, PCK was the second-lowest score among all TPACK domains. Despite being the second domain to get a lower score than the other domains, the lecturers' PCK is still in the excellent category (88.95). It means that the lecturers' capability about the material being taught and how they teach is considered reasonable by the students. The interview result confirmed this data.

The students perceived that the lecturers provided them with an online quiz like *quizizz.com* and participated in group activities. The students said it effectively improved their learning achievement and gave them something new to learn. This statement aligns with Goksun and Gürsoy (2019), who stated that implementing *Quizizz* positively impacted students' achievement and engagement. *Quizizz* may be a creative and promising technology for teachers to involve students in creative learning and interesting competition (Zainuddin et al., 2020).

The study results indicate that lecturers have implemented technology at the content level by providing language-learning software features. The lecturer provides an example of using *QuillBot* to demonstrate how to rephrase writings and select acceptable terms for the issue under discussion. At the same time, at the pedagogical level, lecturers provide students with the opportunity to utilize additional software features taught in class. This can motivate students to explore learning resources independently, allowing them to develop their knowledge.

In addition, the interview results show two points relevant to the research question: observing their lecturers and completing self-learning.

4.1. Observing the Lecturers

Many students responded that they learned TPACK by seeing how their lecturers taught in the classroom in response to several questions. The following statements from students prove this.

> *"From the first semester until now, my lecturers always use technology in teaching. They commonly used media such as PowerPoint, Prezi, and some applications to make lessons less boring like Quizziz."* (Student 8)

> *"Our lecturer always uses various technologies when teaching, especially from the second to the third years. They introduced how to use applications that make it easier to write scientific papers such as Mendeley, Publish or Perish, and Quillbot."* (Student 11)

> *"Yes, my learning achievement improved after using some of the technologies introduced by the lecturers. I am more enthusiastic about doing my assignment because of that."* (Student 14)

Most students claimed that their lecturers had integrated and involved them in using various types of technology and applications, such as *Mendeley*, *Publish or Perish*, and *QuillBot*. Therefore, technology is crucial to the learning process so that the quality of education increases. Çoklar and Yurdakul (2017) confirmed this by stating that improving the quality of education is the most prominent reason educators integrate education with technology. Similarly, Fan and Song (2020) found that utilizing technologies in a classroom environment improved classroom performance and students' classroom experience.

4.2. Completing Self-Learning

Additionally, the second point is referred to the students' daily self-learning, as shown by the following interview results.

> *"I found some other applications that can make it easier for me to write scientific papers. For example, the connected papers application from YouTube helped me write my research background."* (Student 7)

> *"The technology used by the lecturers is beneficial. I became more diligent in using the application and looking deeper into other benefits of the application."* (Student 6)

Furthermore, the results suggested that students obtained their TPACK from self-learning. They become more excited about writing assignments by finding additional applications to help them complete their tasks more efficiently, and their curiosity increases. Technology allows students greater independence and freedom over their learning (Lam & Lawrence, 2010), promotes greater classroom engagement, and supports collaborative learning (Arnone et al., 2011). It can be inferred that technology could help students explore many things and promote student engagement in learning.

5. Conclusion

The average score for all domains is 89.73, with the highest score going to Technological Pedagogical Knowledge (TPK). This suggests that students perceived their lecturers were good enough to implement the technology. It also indicates that lecturers may think they can integrate technology into language learning on either content or pedagogical level. For instance, lecturers introduce writing-assistance software for language learning, such as *QuillBot*. Lecturers introduce various features and provide students with opportunities to learn more features, allowing students to acquire knowledge independently. In addition, there are two approaches for students to gain TPACK in this study. The first is that the students observe how their lecturers teach in class. The second is that the students often complete self-learning using the internet as the media.

6. Recommendations

The limited population and samples limit this study. In order to reach a larger population and investigate other variables, it is anticipated that future research will compare the perspectives of private and public universities regarding the TPACK competencies of their lecturers. Future research can broaden this by population size by comparing technological facilities at private and state universities and the readiness of lecturers and students to implement technology in the learning process. In addition, research variables can be associated with learning models and learning media for better

results. It is expected that future researchers will be able to use instruments that are more inclusive and reflective of twenty-first-century learning.

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Appendix

Undergraduate perceptions of lecturers' TPACK competency

1. My lecturers know basic computer hardware
2. My lecturers know essential computer softwares (e.g., media players, word processing softwares, and web page browsers)
3. My lecturers know how to troubleshoot technical issues related to hardwares (e.g., setting up a printer, using a webcam, and replacing a hard drive)
4. My lecturers know to handle technical issues related to softwares (e.g., installing drivers, setting up WiFi connections, and uploading files to the *Cloud*)
5. My lecturers keep up with significant new technology developments (e.g., e-books, *Google Meet*, and *Zoom Meeting*)
6. My lecturers use many teaching strategies in the classroom (e.g., explaining, asking questions, and group projects)
7. My lecturers use various assessment methods and techniques (e.g., quizzes, reports, and games)
8. My lecturers understand students' problems in the learning process
9. My lecturers adjust their teaching method according to students' achievement and feedback
10. My lecturers know how to manage their class (e.g., establishing clear class rules, fostering a welcoming classroom environment, and fostering positive relationships between students and lecturers)
11. My lecturers have sufficient knowledge about the subjects being taught
12. My lecturers mastered the learning materials
13. My lecturers teach the class naturally in easy-to-understand language
14. My lecturers make materials that can improve my understanding
15. My lecturers answer students' questions by providing precise and relevant examples
16. My lecturers use technology to motivate me to study
17. My lecturers use technology to explain clearly
18. My lecturers use technology to interact more with students
19. My lecturers use technology to aid learning activities
20. My lecturers use appropriate technology for their teaching
21. My lecturers use digital teaching materials so that I can study better
22. My lecturers use digital teaching materials by which I can grasp Indonesian language materials better
23. My lecturers use digital teaching materials so that I can read better
24. My lecturers use digital teaching materials so that I can communicate better
25. My lecturers use digital teaching materials by which I can comprehend the material better
26. My lecturers hold lecturers where I can appreciate learning better
27. My lecturers held a quiz where I could practice more

28. My lecturers make games where I can apply more of the material that has been taught
29. My lecturers hold group activities where I can make more use of their teaching materials.
30. My lecturers hold discussion activities where I can use the learning materials more
31. My lecturers present content with the right strategy using various technologies
32. My lecturers allow us to practice understanding the material with the right strategy using various technologies
33. My lecturers allow us to use learning materials
34. The way my lecturer teaches material using a computer is interesting
35. The way my lecturer teaches material using computers helps me learn better