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The Influence of Technological Knowledge, Pedagogy and Content on Ability Integrate Artificial Intelligence Moderated Gender

Fadilah Mutia Latifah, Muhammad Sabandi✉, Dini Octoria

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Economic Education Study Program, Faculty of Teacher Training and Education, Sebelas Maret University, Surakarta, Indonesia

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Abstract

This study examines the influence of technological knowledge, pedagogical knowledge and content knowledge on the ability to integrate artificial intelligence technology in high school economics teachers in Surakarta and to determine whether gender can moderate technological knowledge, pedagogical knowledge and content knowledge on the ability to integrate artificial intelligence technology in high school economics teachers in Surakarta. The population and sample of 68 were taken using total sampling, namely all high school economics teachers in Surakarta. Data collection using a questionnaire in the form of a google form. The validity test of the instrument used Confirmatory Factor Analysis (CFA) and the reliability test used Cronbach Alpha. Data analysis used hierarchical regression analysis and all data were processed using SPSS 26. The results of the study showed that technological knowledge, pedagogy and content partially had a positive and significant effect on the ability to integrate artificial intelligence technology in high school economics teachers in Surakarta and gender could moderate the relationship between technological knowledge and content with the ability to integrate artificial intelligence technology, but gender could not moderate the relationship between pedagogical knowledge with the ability to integrate artificial intelligence technology.

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✉ Correspondance Address:
Ir. Sutami Street 36 Kentingan, Jebres, Surakarta, Central Java, 57126
Email: muhsabandi@staff.uns.ac.id

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INTRODUCTION

A technology that is currently developing rapidly is artificial intelligence, which is also useful in the field of education. Artificial intelligence is a part of computer science that has the ability to do work like humans, in the field of education it can help improve the quality of education, because it can facilitate the work and tasks of teachers both during learning, curriculum management and the evaluation process. Artificial intelligence is a new pedagogical opportunity that has the potential to encourage a student-centered approach. Artificial intelligence-based tools also help teachers evaluate the teaching process, facilitate lesson planning and implementation, make learning more effective, make difficult concepts easy to learn and help overcome some of the problems faced by students.

Artificial intelligence consists of various types, for example ChatGPT, tutoring systems, dashboards, automatic assessment systems, automatic presentation translators. One of the artificial intelligences is ChatGPT which is a technology to understand and answer questions in text form or provide fast and accurate responses to questions. In the context of learning, ChatGPT can be used as a tool to improve the efficiency and effectiveness of the learning process, to help teachers and students in finding information, help teachers in creating learning materials, help students in doing assignments, improve critical thinking skills, help teachers in deepening learning materials and even help in creating questions instantly. The use of artificial intelligence in learning can help teachers in delivering learning to students and make it easier for students to understand learning. The importance of utilizing learning technology is a guideline for teachers to have technological competence. However, in reality, according to Sukaesih et al. (2017) there are still few teachers who are competent in mastering technology and using it in learning, so that basic competencies are not achieved. The term competence refers to content knowledge, pedagogical and technological competence. According to Koehler et al. (2013) these three competencies are the main components in Technological Pedagogical Content Knowledge (TPACK).

TPACK can be considered as a powerful framework to explain the ability in artificial intelligence-based teaching (Celik, 2023). The development of teacher competencies in the 21st century introduced through the TPACK framework is able to answer the demands of competencies that teachers must have as a need for 21st century learning which requires proficient technology. TPACK is a framework for integrating technology, pedagogy and content in learning. Koehler, et al. (2013) stated that mastering TPACK understanding helps teachers in planning and applying technology-based curriculum. This competency can make it easier for teachers to determine the types of models, learning strategies, media and learning resources that will be used as support in the learning process, this will enable teachers to carry out the learning process optimally.

Data on the quality of education is still less than satisfactory when viewed from the results of the Program for International Student Assessment (PISA) test. The results of the 2022 PISA study, Indonesia is ranked 68th out of 81 countries in the Mathematics test, Science test and Reading Literacy test. The PISA test results show a sharp decline in student performance (steep learning loss) globally over the past four years, namely 2018-2022 and this condition has never happened before. PISA results can also be used to see the level of students' ability to think critically and solve problems. So it is concluded that the quality of education in Indonesia is still quite low compared to other countries. One of the causes of unsatisfactory student achievement is due to the limited ability of teachers in the fields of pedagogical skills and content. The results of Anzora's (2018) study concluded that the TPACK ability of prospective mathematics teachers was in the low category. The results of research by Sidik & Sumartini (2021) also stated that the TPACK of economics teachers was still in the fairly good category, this was

due to the low pedagogical competence of teachers and their understanding in delivering content.

The pedagogical and content knowledge possessed by teachers can be seen from the average score of the teacher competency test on the regional education balance. Teacher competency test is used as a mapping of teacher competency levels. since 2015-2021, teacher competency test results have shown that 80% of teachers in Indonesia have not achieved the minimum score, even based on the results of teacher competency test 2022, the average score still looks low. Yogyakarta is ranked first in teacher competency test scores, while Central Java is ranked second at 63.58, but this score is still below the average set by the government.

Low teacher competency test scores can be used as a reference and evaluation by teachers to further optimize their pedagogical competence in order to become qualified and professional teachers. Research by Demissie et al., (2022) found that technology, pedagogy, and content knowledge are positively related to technology integration. In the research of Karaca et al., (2013, p. 360) stated that technological knowledge has the strongest influence on technology integration. However, research by Shinas et al., (2013) stated that teachers' technological knowledge is lower than pedagogical knowledge. Lack of pedagogical knowledge and skills supported by technology is an important obstacle to technology integration in learning (Hew & Brush, 2007). Research by Santos and Castro (2021) stated that all TPACK components, namely technological knowledge, pedagogical knowledge and content knowledge, have a positive effect on technology integration. Different results were shown by research conducted by Joo et al., (2018) which identified that teachers' intention to use technology in education was not influenced by TPACK but was directly influenced by other factors such as teacher self-efficacy, perceived ease of use, and perceived usefulness of using technology.

Several studies have shown that teacher characteristics also play an important role in integrating technology in various countries, namely significant gender differences with a greater tendency for men towards technology development than women (Marin-Díaz et al., 2020). Research by Suwana & Lily, (2017) revealed that there is a gap in technological knowledge in gender and gender differences affect a person's ability to integrate technology, the results of the study showed that the most dominant were men. This is in line with research by Roussinos & Jimoyiannis, (2019) that gender affects technology and male teachers are more competent than women. Based on the description above, there is inconsistency in the influence of technology integration abilities on the variables of technological knowledge, pedagogy, content knowledge and gender as a moderating variable.

Thus, the focus of this study is to determine whether these variables affect the ability to integrate technology in high school economics teachers in Surakarta or not. The reason for this study on economics teachers is because economics is an important subject that has very complex material, can equip students in thinking, solving problems and has high relevance in everyday life (Santika et al., 2021). In addition, this study also uses control variables, namely School Innovation Climate, Age, School Status, Education Level, Length of Teaching, Principal Leadership Style.

METHODS

This type of research is quantitative research using statistical data. The population in this study were all high school economics teachers in Surakarta, Central Java, using a sampling technique based on Sugiyono, (2018) namely total sampling because the population was small, namely 68 high school economics teachers in Surakarta. This study uses a data collection technique in the form of a questionnaire link namely Google form, which was distributed to all high school economics teachers in Surakarta. To measure technological knowledge, pedagogical knowledge, content knowledge, gender as a moderating variable, and the ability to integrate artificial intelligence technology using a Likert scale type.

The ability to integrate artificial intelligence technology uses three indicators from Celik, (2023) has three indicators including how to use various artificial intelligence-based technologies, being an example for other teachers in using artificial intelligence-based technology, choosing the right technology for learning.

Technological knowledge uses two indicators from Santos and Castro (2021), namely knowledge in solving technological problems and the ability to utilize technology.

Pedagogical knowledge is measured using indicators proposed by Santos and Castro (2021), including managing students, supporting student problem solving, guiding student discussions, selecting and using learning methods, compiling and using evaluation tools.

Content knowledge is measured using indicators by Santos and Castro (2021), namely mastery of material, developing material, breadth and depth of material. Meanwhile, gender indicators are divided into two, namely male and female (Akram et al., 2021).

All questionnaire statements were first tested for validity using the Confirmatory Factor Analysis (CFA) method and reliability tests using Cronbach Alpha. Data analysis techniques through descriptive tests, prerequisite analysis tests, while hypothesis testing uses hierarchical regression analysis, t-tests, and coefficient of determination analysis.

RESULTS AND DISCUSSION

This study analyzes the influence of technological knowledge, pedagogical knowledge and content knowledge on the ability to integrate artificial intelligence technology in high school economics teachers in Surakarta with gender as a moderating variable. The control variables used in this study are school innovation climate, age, school status, education level, length of teaching, and principal leadership style. The questionnaire was filled out by 68 respondents from high school economics teachers in Surakarta.

The sample in this study amounted to 68 respondents with the subject of high school economics teachers in Surakarta with the characteristics in Table 1.

Table 1. Characteristics of Research Respondents

Descriptive Statistic		
Variable control	Frequency	Precentage (%)
Age		
<20 year	0	0%
20-29 year	9	13%
30-39 year	15	22%
>40 year	44	65%
School status		
State	32	47%
Private	36	53%
Employment status		
PNS	30	44%
Non PNS	38	56%
Level of education		
SMA/K	9	13%
D3	0	0%
S1	47	69%
S2	12	18%
S3	0	0%
Years of teaching		
< 2 years	6	8.82%
2-6 years	12	17.65%
> 6 years	50	73.53%
Principal Leadership Style		
Autocratic	4	6%
Democratic	63	93%
Laissez faire	1	1%

Source: Processed Primary Data, 2024

Table 2. Hierarchical Regression Test Results Before Adding Control Variables

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Main Variable									
Technological knowledge (X1)	1.353*** (7.496)	-	-	-	0.542** (2.269)	-	-	-	2.443*** (3.051)
Pedagogical knowledge (X2)	-	0.685*** (8.079)	-	-	0.339*** (2.842)	-	-	-	2.301*** (4.039)
Content knowledge (X3)	-	-	1.221*** (6.871)	-	0.491** (2.370)	-	-	-	2.141*** (2.554)
Gender (M)	-	-	-	-0.234 (-0.141)	-0.283 (-0.255)	-	-	-	-5.890 (-0.824)
Interaction Variable									
X1*M	-	-	-	-	-	0.292*** (3.909)	-	-	1.682*** (3.644)
X2*M	-	-	-	-	-	-	0.118*** (3.425)	-	-1.060*** (-3.513)
X3*M	-	-	-	-	-	-	-	0.259*** (3.584)	1.371*** (2.982)
Constant	4.881	0.211	6.356	26.034	2.718	17.652	17.732	18.327	6.852
N	68	68	68	68	68	68	68	68	68
R	0.678[a]	0.705[a]	0.646[a]	0.017[a]	0.774[a]	0.434[a]	0.388[a]	0.404[a]	0.841[a]
R^2	0.460	0.497	0.417	0.000	0.598	0.176	0.138	0.150	0.674

Description: *** p < 0.01; ** p < 0.05; * p < 0.1

Source: Processed Primary Data, 2024

Based on the results of data testing with SPSS that the researcher conducted, the tcount test of the technological knowledge in all models (see models 1, 5, 9, 10, 14 and 18) is greater when compared to the t table with a Sig. value is <0.05, so that the technological knowledge (X1) has a positive and significant effect on the ability to integrate artificial intelligence technology, the conclusion is that H1 is accepted.

The t-value of pedagogical knowledge in all models (see models 2, 5, 9, 11, 14 and 18) is also greater when compared to t-table with Sig. <0.05, so that the pedagogical knowledge (X2) has a positive and significant effect on the ability to integrate artificial intelligence technology, the conclusion is that H2 is accepted.

The content knowledge in models 3, 5, 9, 12, 14 and 18 has a t-value> 1.997 with a Sig. <0.05, so that the content knowledge (X3) has a positive and significant effect on the ability to integrate artificial intelligence technology, the conclusion is that H3 is accepted.

Gender becomes a moderating variable between the technological knowledge and the ability to integrate artificial intelligence technology through the X1.M variable which can be seen in models 6, 9, 15 and 18. In model 15 the t-value > t-table and the Sig value

Table 3. Hierarchical Regression Test Results After Adding Control Variables

Variable	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18
Main Variable									
Technological knowledge (X1)	0.676*** (2.885)	-	-	-	0.288** (2.144)	-	-	-	2.221*** (2.812)
Pedagogical knowledge (X2)	-	0.426*** (3.765)	-	-	0.252** (2.888)	-	-	-	2.302*** (4.020)
Content knowledge (X3)	-	-	0.685*** (3.542)	-	0.409** (2.871)	-	-	-	2.355*** (2.713)
Gender (M)	-	-	-	0.196 (0.162)	-0.259 (-0.236)	-	-	-	-2.111 (-0.296)
Interaction Variable									
X1*M	-	-	-	-	-	0.610* (2.725)	-	-	1.414*** (3.081)
X2*M	-	-	-	-	-	-	0.044 (1.555)	-	-1.081*** (-3.645)
X3*M	-	-	-	-	-	-	-	0.117* (1.995)	1.445*** (3.088)
Control Variable									
School Innovation Climate (K1)	0.638*** (3.806)	0.536*** (3.270)	0.692*** (4.902)	0.983*** (7.726)	0.397** (2.257)	0.896*** (6.747)	0.914*** (6.953)	0.908*** (7.903)	0.321** (2.068)
Age (K2)	-2.231*** (-2.537)	-2.342*** (-2.816)	-2.047** (-2.384)	-2.777*** (-3.014)	-1.863** (-2.222)	-2.428*** (-2.645)	-2.529*** (-2.768)	-2.378** (-2.611)	-1.587** (-2.108)
School Status (K3)	-0.514 (-0.521)	-1.049 (-1.116)	0.344 (0.340)	-0.883 (-0.845)	-0.087 (-0.087)	-0.785 (-0.769)	-0.951 (-0.928)	-0.571 (-0.559)	-0.370 (-0.409)
Level of Education (K4)	0.013 (-0.022)	-0.004 (-0.007)	0.155 (0.270)	0.138 (0.218)	-0.006 (-0.011)	0.175 (0.284)	0.179 (0.290)	0.201 (0.329)	-0.046 (-0.093)
Years of Teaching (K5)	0.936 (0.985)	0.408 (0.444)	0.633 (0.685)	0.867 (0.854)	0.491 (0.543)	0.793 (0.800)	0.692 (0.692)	0.688 (0.698)	0.161 (0.199)
Principal Leadership Style (K6)	2.377 (1.664)	2.668** (1.953)	1.941 (1.388)	2.727* (1.794)	2.065 (1.517)	2.625* (1.769)	2.753* (1.848)	2.563* (1.740)	2.151* (1.737)
Constant	2.438	1.648	-0.553	5.447	-1.335	3.829	4.154	3.019	1.887
N	68	68	68	68	68	68	68	68	68
R	0.772[a]	0.792[a]	0.787[a]	0.735[a]	0.814[a]	0.749[a]	0.747[a]	0.754[a]	0.869[a]
R^2	0.596	0.628	0.619	0.540	0.663	0.561	0.557	0.568	0.755

Description: *** p < 0.01; ** p < 0.05; * p < 0.1

Source: Processed Primary Data, 2024

>0.05, while in models 6, 9, and 18 it is proven that tcount > ttable and Sig. value< 0.05. The inconsistent regression results conclude that more regression results are influential and significant, so that gender can moderate the technological knowledge on the ability to integrate artificial intelligence technology, the conclusion is that H4a is accepted.

Gender is also a moderating between the pedagogical knowledge and the ability to integrate artificial intelligence technology through the variable X2.M which can be seen in models 7, 9, 16 and 18. In model 7, the t-count value is > t-table and the Sig. value is <0.05 so that H4b is only accepted in model 7, while in models 9, 16 and 18 it is proven that it cannot affect the ability to integrate artificial intelligence technology because t-count<t-table. The inconsistent regression results and more models showing the rejection of H4b, it is concluded that H4b is rejected, which means that gender cannot moderate the pedagogical knowledge on the ability to integrate artificial intelligence technology.

Finally, gender is also a moderating between the content knowledge and the ability to integrate artificial intelligence technology through the variable X3.M which can be seen in models 8, 9, 17 and 18. In model 17, the t-count value is <t-table and the Sig. value. > 0.05 so that H4b is only rejected in model 17, while in models 8, 9 and 18 it is proven to affect the ability to integrate artificial intelligence technology because t count > t table and Sig. < 0.05. The inconsistent results of the regression and more models indicate the acceptance of H4c, it is concluded that H4c is accepted, which means that gender can moderate the content knowledge on the ability to integrate artificial intelligence technology.

Based on the results of the hypothesis through the t test, it can be concluded that the independent variables of the study partially have an influence on the dependent variable. Technological knowledge has a positive and significant effect on the ability to integrate artificial intelligence technology, pedagogical knowledge has a positive and significant effect on the ability to integrate artificial intelligence technology and content knowledge has a positive and significant effect on the ability to integrate artificial intelligence technology.

The gender moderating variable as an interaction variable with technological knowledge and content knowledge has a positive and significant effect on the ability to integrate artificial intelligence technology, while the gender moderating variable as an interaction variable with pedagogical knowledge does not have a positive and significant effect on the ability to integrate artificial intelligence technology, meaning that gender cannot strengthen or weaken pedagogical knowledge on the ability to integrate artificial intelligence technology.

TPACK is a framework for integrating technology, pedagogy and content in learning. Koehler et al., (2013) stated that mastery of TPACK understanding helps teachers in planning and applying technology-based curriculum. This competency can make it easier for teachers to determine the type of model, learning strategy, media and learning resources that will be used as support in the learning process, this will enable teachers to carry out the learning process optimally. TPACK can be considered a strong framework for explaining capabilities in artificial intelligence-based teaching (Celik, 2023).

The Influence of Technological Knowledge on Artificial Intelligence Technology Integration Capabilities

Based on the test, hypothesis one (H1) through hierarchical regression analysis resulted in the conclusion that H1 was accepted, namely that technological knowledge has a significant effect on the ability to integrate artificial intelligence technology. This illustrates that the higher the technological knowledge of teachers, the higher the ability to integrate technology into economics learning. Increasing this integration ability can foster a positive attitude towards the use of technology and ultimately result in its use in various ways.

In line with the research results of Demissie et al., (2022) who stated that technology is positively related to technology integration. Likewise, the research of Karaca et al., (2013, p. 360) stated that technological knowledge has the strongest effect on technology integration. However, this study showed that technological knowledge has the lowest influence among other variables when not added with control variables. This is in line with the research of Shinas et al., (2013) which stated that teachers' technological knowledge is lower than pedagogical knowledge. Hew and Brush (2007) built a theoretical model to identify the relationship between variables that influence technology integration. In this model, technology integration is directly influenced by teacher knowledge and skills, teacher attitudes and beliefs toward technology use, institutions, and resource availability.

Information and Communication Technology (ICT) in the teaching and learning process has become very common today. Activities that integrate technology will increase students' awareness to become more effective and creative thinkers in facing learning. This provides easy access to discussions and involves students more in the teaching and learning process when using technology.

Teachers who are accustomed to using technology in various ICT-based activities will help have various strong abilities in technological knowledge, such as determining the right technology, how to use it and solving problems with technology. Therefore, technological knowledge is undoubtedly one of the foundations of learning technology integration, and this study shows that increasing teachers' technological knowledge will increase teachers' use of ICT in the classroom. Oliva-Cordova et al. (2021) stated that the use of technology in teaching practices makes it easy for students to learn, but its efficient application still depends on the teacher's technological and pedagogical knowledge, therefore by increasing teachers' technological knowledge, students will also have an easy learning experience. Technological knowledge also includes an interest in following technological developments. Teachers with higher technological knowledge are able to apply technological devices in their professional and daily lives and can easily understand the extent to which technology can support or hinder task completion.

The Influence of Pedagogical Knowledge on Artificial Intelligence Technology Integration Ability

The results of the second hypothesis study (H2) through hierarchical regression analysis resulted in the conclusion that H2 was accepted, namely that pedagogical knowledge had a significant influence on the ability to integrate artificial intelligence technology. In line with research (Shinas et al., 2013) which states that pedagogical knowledge has an effect on technology integration. Perdani & Sri Andayani, (2022) also stated that pedagogical knowledge has a positive and significant effect, the highest among other variables, namely content knowledge. Likewise, this study also obtained results that pedagogical knowledge has the highest effect compared to other variables. This illustrates that when teachers have high pedagogical knowledge, the intensity of integrating technology into economics learning will also be high. Artificial intellegence technology can be used for effective teaching when teachers have sufficient pedagogical knowledge to utilize artificial intelligence-based tools (Cavalcanti et al., 2021). Therefore, pedagogical knowledge is very important for the implementation of artificial intellegence based technology. The quality of education is recognized as an important and critical aspect of development. Therefore, to achieve quality education, teachers ensure the development of the potential of the younger generation. To develop this potential, teacher education institutions are tasked with preparing future teachers who are equipped with pedagogical knowledge.

One of the artificial intelligence technologies is chatbot. Chatbots function as conversational or virtual agents for learners and teachers. Educators can initiate a conversation with Chatbots through voice or text input, teachers can utilize Chatbots to get help in maintaining student learning motivation, in addition, Chatbots can send notifications to teachers about student learning progress (Celik, 2023). Intelligent tutoring systems can also be used interchangeably with adaptive learning systems and personalized learning platforms. In these systems or platforms, students are provided with learning content based on student needs. Intelligent tutoring systems reduce the workload of teachers, thereby giving teachers more time during learning (Celik, 2023).

Artificial intelligence enhanced dashboards allow teachers to monitor student knowledge construction, cognitive and emotional engagement (Hew & Brush, 2007). Automated assessment systems recognize and automatically assess student responses. These tools are also known as automated assessment systems. This is represented as being able to help teachers organize and support learning progress.

The Influence of Content Knowledge on Artificial Intelligence Technology Integration Ability

The results of the statistical calculation of the third hypothesis (H3) through hierarchical regression analysis resulted in the conclusion that H3 was accepted, namely that content knowledge influences the ability to integrate artificial intelligence technology. This finding is in line with (Santika et al., 2021) and Akram, (2021) which show that economics teachers content knowledge influences technology interaction and has the highest level. This finding is reinforced by research by Perdani & Sri Andayani, (2022) which states that content knowledge has a positive and significant effect, but the content is relatively low. This is contrary to research by Joo et al., (2018) which identified that technology integration in education is not influenced technological, pedagogical and content knowledge but is directly influenced by other factors such as teacher self-efficacy, perceived ease of use, and perceived usefulness of technology use.

With content knowledge, teachers are able to respond to class needs. Professional teachers can utilize their knowledge of economic subjects to organize and use their knowledge more effectively so that students can understand it. Artificial intelligence technology can contribute to teachers' content knowledge, for example teachers can search for lesson materials using chatbot or other WEBs and summarize them which will then be used as learning materials in class.

Gender Moderates the Relationship between Technology Knowledge and Artificial Intelligence Technology Integration Ability

The results of the H4a study through hierarchical regression analysis resulted in the conclusion that H4a was accepted, namely that the gender moderating variable can moderate technological knowledge on the ability to integrate artificial intelligence technology. So that the gender variable can be said to have a strong influence on technological knowledge on the integration of artificial intelligence technology. This is in line with Marín-Díaz et al., (2020) which states that men tend to be greater towards technology integration than women.

Suwana and Lily's research, (2017, p. 216) also revealed that there is a gap in technological knowledge in gender and gender differences affect a persons ability to integrate technology, the results of the study showed that the most dominant were men, the same as this study which resulted in the conclusion that men are more dominant than women, although there are many female technology users, the ability to use and utilize it is still low, this is due to the background of the educational environment, lack of skills and facilities and lack of information technology training

for women and the influence of patriarchal culture. This is further strengthened by research by Roussinos and Jimoyiannis, (2019, p. 14) that gender influences technology and male teachers are more competent than female teachers. Cheng and Xie (2018) also stated that gender can strengthen technological competence towards integrating technology and the tendency towards men rather than women.

Gender Cannot Moderate the Relationship between Pedagogical Knowledge and Artificial Intelligence Technology Integration Ability

The results of the H4b study concluded that H4b was rejected, namely that the gender moderating variable cannot moderate pedagogical knowledge on the ability to integrate artificial intelligence technology. The results of the study showed that pedagogical knowledge influenced the ability to integrate artificial intelligence technology but was not strengthened or weakened by gender (there was no difference between men and women). This shows that both men and women have the same interest in mastering pedagogical knowledge in order to support the ability to integrate artificial intelligence technology in learning so that the teaching and learning process becomes effective. The results of this study are not in line with (Ortega-Sanchez & Gomez-Trigueros, 2020); Lin et al., (2013) who explained that there are gender differences, namely higher pedagogical knowledge in female teachers. Castera et al. (2020) found the same results as this study, that gender cannot moderate technology integration.

This result is in accordance with feminist theory, which states that men and women have the same opportunities in how to think about determining learning strategies, managing classes, guiding students and using effective and efficient assessment methods in learning.

Gender Moderates the Relationship between Content Knowledge and Artificial Intelligence Technology Integration Ability

The results of the H4c study through hierarchical regression analysis resulted in the conclusion that H4c was accepted, namely that the gender moderating variable can moderate content knowledge on the ability to integrate artificial intelligence technology. So that the gender variable can be said to have a strong influence on content knowledge on the integration of artificial intelligence technology. The results of this study are supported and in line with the research of Ortega-Sanchez & Gomez-Trigueros, (2020) which states that teacher content knowledge can strengthen and influence technology integration. However, this finding contradicts the research of Castera et al., (2020) which states that gender cannot moderate TPACK, including content knowledge on technology integration, this makes men and women have the same responsibility and rights in utilizing the content knowledge they have to be integrated into technology. In contrast to this study which states that content knowledge is higher in male teachers than female teachers.

The dominance of male teachers can occur because self-efficacy and self-confidence in women are lower than in men. Self-efficacy refers to a person's belief or confidence in their ability to overcome certain tasks or challenges. Self-confidence is a person's general belief in their overall abilities. This is supported by research by Trimayati, et al., (2023); Fatma (2015); Listiyanto & Sutarto (2016) which states that there are differences in self-confidence in terms of gender between men and women, men have higher self-confidence compared to women. Self-confidence is very much needed by someone, including teachers. Self-confidence in teachers can encourage them to be able to freely express all their abilities, one of which is the knowledge of learning content

that teachers have. Confidence and self-confidence in teachers are very important for success in achieving learning goals.

Control Variables on Artificial Intelligence Technology Integration Capabilities

This study contains control variables, namely school innovation climate, age, school status, education level, length of teaching, principal leadership style. The results of the study showed that the school innovation climate is one of the important factors and has a significant influence on the ability to integrate artificial intelligence technology, which means that the better and more positive the innovation climate in schools, such as teachers who are willing to try, develop and have a positive attitude towards new ideas in learning, teachers who are willing to take risks to make their schools better, teachers who continue to improve their teaching and teachers are actively involved in their professional development activities, then the technological knowledge, pedagogical knowledge and content knowledge possessed by teachers will increase, this will encourage teachers to improve their artificial intelligence technology integration capabilities. The age control variable also plays an important role and has a significant influence on the ability to integrate artificial intelligence technology, which means that the younger the teacher's age, the technological knowledge, pedagogical knowledge and content knowledge possessed by teachers will increase, this will encourage teachers to improve their artificial intelligence technology integration capabilities.

The control variables of school status, education level, length of teaching and principal's leadership style do not have a significant effect on the ability to integrate artificial intelligence technology. This shows that when viewed from the school status (public or private high school), viewed from the teacher's education level (high school/high school graduate, D3, S1, S2, S3), from the length of teaching (0 - >6 years), and viewed from the principal's leadership style (Democratic, autocratic, laissez faire) there is no difference in determining the ability to integrate artificial intelligence technology.

CONCLUSION

Based on the results of hypothesis testing with statistical analysis, it can be concluded that technological knowledge, pedagogical knowledge and content knowledge have a positive and significant effect on the ability to integrate artificial intelligence technology. Gender moderation is also able to strengthen technological knowledge and content knowledge on the ability to integrate artificial intelligence technology with the most dominant being men. However, gender is unable to strengthen or weaken pedagogical knowledge on the ability to integrate artificial intelligence technology, this can explain that both men and women will be able to have the same pedagogical mastery in integrating technology into economic learning.

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