Article

Encontros Bibli

EVALUATING THE EFFECTIVENESS OF A BLENDED LEARNING SYSTEM FOR DEVELOPING TECHNOLOGICAL ANDRAGOGICAL CONTENT KNOWLEDGE (TACK) IN COMMUNITY EDUCATORS

Avaliando a eficácia de um sistema de aprendizagem combinado para o desenvolvimento de conhecimento de conteúdo tecnológico andragógico (tack) em educadores comunitários

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ABSTRACT

Objective: The relevance of content knowledge, as well as andragogical knowledge and technological knowledge, is rapidly coming into focus as a challenge to turn into Technological Andragogical Content Knowledge (TACK). This study aimed to understand better the substantial variations in learning outcomes attributed to each of the seven sub-indicators of comprehension of technological andragogical content knowledge.

Method: This study part of quantitative study. The data were gathered twice in this research, once before and once after the TACK intervention program began, to examine the impact of the TACK training paradigm. The TACK Training Model Development program was offered to 97 instructors from 28 Community Learning Activity Centers in the West Sumatra Province, Indonesia. These instructors engaged in the program on a voluntary basis.

Result: The results of this study show that there was a statistically significant difference in TACK among currently practicing educators. This study suggests that a blended learning system for educational applications as an intelligence tutor may provide an alternate means of guiding educators. The findings of this research align with other research suggesting that the blended learning strategy has great potential for future TACK-based professional learning enabled by data analytics. This study's findings add to the expanding body of literature on blended learning in teacher education and teacher

professional development, which seeks to enhance how adult instructors get specialized professional training to significantly impact their students' achievements.
Conclusions: According to the findings, the TACK of the participants showed substantial signs of improvement. These findings contribute to the relatively small body of research that has been done on TACK, which helps adult educators further their professional development through the support of a blended learning system. This allows them to acquire the knowledge necessary to andragogically incorporate digital technology into students' educational experiences in Community Learning Activity Centers. This investigation has the potential to serve as a case study of the integration of blended learning with adult learning theory.
KEYWORDS: Content Knowledge. Andragogical Knowledge. Technology Knowledge. Equality Education. Non-Formal Education.

RESUMO
Objetivo: A relevância do conhecimento de conteúdo, bem como do conhecimento andragógico e do conhecimento tecnológico, está rapidamente ganhando destaque como um desafio para se transformar em Conhecimento Tecnológico Andragógico de Conteúdo (TACK). Este estudo teve como objetivo compreender melhor as variações substanciais nos resultados de aprendizagem atribuídas a cada um dos sete subindicadores de compreensão do conhecimento do conteúdo andragógico tecnológico.
Método: Este estudo parte de um estudo quantitativo. Os dados foram recolhidos duas vezes nesta investigação, uma vez antes e outra depois do início do programa de intervenção TACK, para examinar o impacto do paradigma de formação TACK. O programa de Desenvolvimento de Modelo de Treinamento TACK foi oferecido a 97 instrutores de 28 Centros Comunitários de Atividades de Aprendizagem na Província de Sumatra Ocidental, na Indonésia. Esses instrutores participaram do programa de forma voluntária.
Resultados: Os resultados deste estudo mostram que houve uma diferença estatisticamente significativa no TACK entre os educadores atuantes atualmente. Este estudo sugere que um sistema de aprendizagem combinado para aplicações educacionais como tutor de inteligência pode fornecer um meio alternativo de orientar educadores. As conclusões desta investigação alinham-se com outras pesquisas que sugerem que a estratégia de aprendizagem combinada tem um grande potencial para a futura aprendizagem profissional baseada no TACK, possibilitada pela análise de dados. As conclusões deste estudo contribuem para o crescente corpo de literatura sobre aprendizagem combinada na formação de professores e no desenvolvimento profissional de professores, que procura melhorar a forma como os instrutores adultos obtêm formação profissional especializada para impactar significativamente o desempenho dos seus alunos.
Conclusão: De acordo com os resultados, o TACK dos participantes apresentou sinais substanciais de melhoria. Estas descobertas contribuem para o corpo relativamente pequeno de investigação realizada sobre o TACK, que ajuda os educadores de adultos a promover o seu desenvolvimento profissional através do apoio de um sistema de aprendizagem combinado. experiências educacionais em Centros Comunitários de Atividades de Aprendizagem. Esta investigação tem o potencial de servir como um estudo de caso da integração da aprendizagem combinada com a teoria da aprendizagem de adultos.
PALAVRAS-CHAVE: Conhecimento de Conteúdo. Conhecimento Andragógico. Conhecimento Tecnológico. Educação para a Igualdade. Educação Não Formal.

1 INTRODUCTION

In recent years, the use and influence of andragogical knowledge in educational settings have seen a notable increase (Roessger; Roumell; Weese, 2022). This attention from researchers, developers, and practitioners underscores its potential to enhance both classroom practices and student understanding (Ottonicar; Valentim, 2019; Chaipidech *et al.*, 2022; Marinho; Pereira; Segundo, 2022). Particularly, Andragogical knowledge has expanded to include the attention of researchers in computer science and education, leading to the development of a new concept called Technological Andragogical Knowledge (TAK) (Santos, 2012). Despite this, there remains a lack of clarity on how effectively leverage TAK on a broader scale and its meaningful impact on teaching and learning (Arifin *et al.*, 2020).

More recently, the concept of Technological Andragogical Knowledge has evolved to encompass the integration of Andragogical Knowledge technologies or application

programs into educational services to assist students in their education by providing blended learning guidance, support, feedback, and instruction, as well as aiding educators and policymakers in their decision-making processes (Arifin *et al.*, 2020; Simbolon *et al.*, 2020). Blended learning applications that tailor advice and assistance to each learner's unique needs in terms of prior knowledge, interests, and other factors are a primary goal of andragogical research (Long; Torrence, 2021). However, using these capabilities would need a shift and expansion of how instructors acquire the necessary information in professional learning and development settings. Educators, researchers, and practitioners from the domains of technological andragogical knowledge face additional obstacles when trying to apply andragogical knowledge to the implementation of relevant professional learning activities using blended learning (Hoppen; Vanz, 2020).

Moreover, the evolution of Technological Andragogical Knowledge extends beyond mere integration, potentially leading to the development of Technological Andragogical Content Knowledge (TACK), which remains relatively unexplored in blended learning context (Alamri; Watson; Watson, 2021). Therefore, it will be crucial that high-quality blended learning programs be established as part of the ongoing efforts to enhance education.

To date, TACK enhancements have been implemented in various forms. Educators, policymakers, and researchers should seriously explore TACK initiatives to adapt to the demands of the modern digital world. TACK has the potential to provide alternative pedagogical approaches that allow for more profound teacher training (Bueno *et al.,* 2022). Scholars have also noted that a blended learning approach may aid educators in becoming better at what they do (Prafitasari; Sukarno; Muzzazinah, 2021; Sulisworo *et al.*, 2020; Tupas; Linas-Laguna, 2020). Blended learning systems have tremendous potential in TACK for improving educational equity by creating more targeted learning activities and more effective technology-enhanced applications and settings. According to the widespread discussion around the Technological Andragogical Content Knowledge (TACK) integrative framework, a competent educator in the digital world must integrate three distinct types of knowledge: content knowledge, andragogical knowledge, and technical knowledge. As mentioned earlier, an equal educational opportunity was also necessary for effectively combining the facets of knowledge. Educators, researchers, and practitioners must explore how blended learning can be integrated into TACK to promote educational equity. TACK is the new knowledge instructors must acquire to teach using technology successfully.

Blended learning, when integrated into TACK, plays a pivotal role in developing a TACK training model that serves as an intelligent tutor, thereby promoting professional teaching in equality education. This study developed a specific TACK training model and proposed its implementation framework in the context of TACK development. Additionally, it investigated the initial efficacy of the TACK training model with an embedded blended learning system for experienced and non-experienced instructors to promote educational equity. Therefore, this study aimed to find out whether a Blended Learning System supporting the TACK training model will influence instructor`s knowledge of professional teaching in equality education. The main objective of this study was to evaluate the effectiveness of a TACK training model that utilized a blended learning system in developing the seven sub-indicators of TACK comprehension among community instructors in Community Learning Activity Centers.

2 METHODOLOGY

2.1 Research Design

This study part of quantitative study. The data were gathered twice in this research, once before and once after the TACK intervention program began, to examine the impact of the TACK training paradigm (Hodge, 2020). The hypothesis of this research was that there was a statistically significant difference in TACK among currently practising educators. Information on a nine-day intensive training program that uses the TACK framework and the blended ubiquitous learning system to promote educational equity has been developed. All participating classroom instructors freely participated in the February 2022 professional development program. They learned how to deliver the lesson at the TACK workshop. All participants attended the first face-to-face session of the intense TACK training. In-service science educators could engage with the complete system of self-directed professional development thanks to the Blended learning environment. Upon completion of the TACK training model's learning and assessment, an introductory context for instructional pain points and results from research-based learning innovation was provided. The next step, after the Inspiration phase, was the Conceptualization phase. Instructors took part in a learning-by-learning simulation in which they acted out the roles of students. The workshop's second day starts with a comprehensive lesson on teaching. At this stage, dubbed Consolidation, participants were encouraged to use a designated mobile app in tandem with a genuine task. They were then urged to strengthen their pedagogical routines. The next

session will have students interacting with a professional with extensive experience using the Blended Learning System. The TACK findings from the Blended learning system are tracked and monitored throughout the final training workshop session. The researchers utilized the findings to provide suggestions and spark debate among the participants about the TACK outcomes.

2.2 Participants

Instructor professional development courses were used to put into practice the findings of this study. The training was conducted in accordance with the pedagogical approach. This study's authors led the Teacher Professional Development (TPD) training initiative. The participants in this research were 97 active educators from Community Learning Activity Centers in the Indonesian state of West Sumatra. Participants were chosen to participate in a training program to improve their foundational skills for using technology in classroom instruction and learning. Before this research, they had prior experience utilizing digital technology in the classroom. Most of them had earned master's degrees in teaching and had at least a bachelor's degree.

2.3 Technological Andragogical Content Knowledge (TACK) Framework

In this study, the Comprehension of Technological Andragogical Content Knowledge framework served as a foundational lens for assessing instructors' proficiency in integrating technology, pedagogy, and content knowledge in adult education settings. The framework encompassed seven distinct sub-indicators, each vital for effective teaching and learning:

Content Knowledge (CK) pertained to instructors' depth of understanding regarding the subject matter or content to be taught. This included familiarity with key concepts, theories, and factual information within the specified domain.

Andragogical Knowledge (AK) delved into instructors' comprehension of the principles and practices of adult learning theory. This involved an understanding of how adults learn best, their motivations, learning preferences, and the strategies conducive to facilitating their learning effectively.

Technological Knowledge (TK) focused on instructors' familiarity and competence with various technologies and their potential applications for teaching and learning purposes. This entailed understanding the functionalities and affordances of different technological tools and resources.

Andragogical Content Knowledge (ACK) encompassed instructors' ability to apply andragogical principles to teach specific content effectively. This involved aligning teaching strategies with adult learning principles to cater to the unique needs and characteristics of adult learners.

Technological Content Knowledge (TCK) involved understanding how technology could be utilized to represent and teach specific content. Instructors needed to possess the knowledge and skills to select appropriate technological tools and resources to enhance content presentation and comprehension.

Technological Andragogical Knowledge (TAK) centered on instructors' understanding of how technology could be employed to support and enhance andragogical practices. This included leveraging technological tools and resources to facilitate adult learning principles such as self-directed learning, experiential learning, and collaborative knowledge construction.

Technological Andragogical Content Knowledge (TACK) represented the integration of all three components—content knowledge, andragogical knowledge, and technological knowledge. Instructors proficient in TACK demonstrated a comprehensive understanding of how technology could be effectively used to support andragogical practices in teaching specific content to adult learners.

By assessing instructors across these seven sub-indicators, the study aimed to provide insights into their overall proficiency in integrating technology, pedagogy, and content knowledge to enhance teaching effectiveness in adult education contexts.

The researchers developed a 45 item multiple-choice, closed-ended questionnaire to assess the participants' Technological Andragogical Content Knowledge (TACK). Five experts verified the questionnaire items for validity. The questionnaire comprised specific sections targeting various aspects of TACK, including 17 questions on general Content Knowledge (CK), five questions on Andragogical Knowledge (AK), six questions on Technological Knowledge (TK), three questions each on the intersections of Andragogical and Content Knowledge (ACK), Technological and Content Knowledge (TCK), and Technological and Andragogical Knowledge (TAK), and eight questions on the integration of all three components (TACK). The reliability coefficient of the questionnaire was measured at 0.75. Completing the questionnaire typically required approximately 45 minutes for the participating instructors.

2.4 Data Analysis

The TACK scores before and after the intervention have been conducted to evaluate the efficacy of the TACK intervention that may alter the cognitive element of TACK among the instructors. Their TACK was evaluated using a multiple-choice, closed-ended survey. The researchers created the questionnaire and then verified it with five specialists. There are 45 different questions. There are 17 questions about general CK, five about AK, six about TK, three about ACK, three about TCK, three about TAK, and eight about TACK. It had a trustworthiness of 0.75. The study's TACK questions take around 45 minutes to complete.

Researchers modified data by omitting missing information before using it to analyze the intervention program (Humble, 2020). For instance, instructors who did not finish the exercises during the workshop were not allowed to continue. In order to analyze the data, researchers employed IBM SPSS Statistics 24. Initially, the Shapiro-Wilk test was run to ensure that the test results did not deviate from a customarily distributed distribution when comparing them before and after the intervention. Subsequently, a one-way ANOVA analysis was performed at a 95% confidence level on the observed data produced by all variables. The post hoc Least Significant Difference (LSD) test was then used to see whether there were statistically significant differences between each sub-indicator.

3 RESULTS

3.1 Normality Test

Using the normality test, the data were tested to see whether their data followed a normal distribution. The Shapiro-Wilk test was performed to determine whether or not the data in this research followed a normal distribution; the findings are shown in the Table 1.

Table 1 - Shapiro wilk statistical test results

Understanding Indicator		Shapiro-Wilk		
		Statistic	df	Sig.
Learning Outcomes	CK	.929	17	.210
	AK	.842	5	.171
	TK	.794	6	.051
	ACK	.987	3	.780
	TCK	.984	3	.762
	TAK	.794	3	.100
	TACK	.832	8	.062

Source: Elaborated by authors (2023).

Based on Table 1, all data groups have Sig. Values greater than 0.05 which indicate that they follow a normal distribution, as determined by the above output results from the normality test using the Shapiro-Wilk test.

3.2 Homogeneity Test

Next, we assume homogeneity between the two analyzed sample classes, given that both are normally distributed. The homogeneity test was performed to see whether there was a similar variance between the two sample groups. The Table 2 displays the results of the SPSS test used to test hypotheses in this research.

Table 2 - Test of homogeneity of variances

Levene Statistic	df1	df2	Sig.
1.567	6	38	.183

Source: Elaborated by authors (2023).

The output in Table 2 shows that the seven data sets have the same variance or homogeneity since the value of Sig. was 0.183, which was more significant than 0.05. Then all the necessary analytic conditions for one-way ANOVA, a kind of parametric statistical testing, have been satisfied.

3.3 Hypothesis Test - One-Way ANOVA Test

After ensuring that both sample classes were regular and homogenous using a pre-requisite test, we proceeded to test the hypothesis with a One-Way ANOVA. Given the seven possible outcomes, we applied the One-Way ANOVA test to analyze the data (CK,

AK, TK, ACK, TCK, TAK, and TACK). A One-Way ANOVA test was used to determine whether there was a significant difference in the mean of the seven indicators of Technological and Pedagogical Content Knowledge.

H0 = There was no significant difference in learning outcomes from seven sub-indicators of understanding about technology andragogical content knowledge.

H1 = There was significant difference in learning outcomes from seven sub-indicators of understanding about technology andragogical content knowledge.

Table 3 - ANOVA one-way results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	335.444	6	55.907	1.054	.407
Within Groups	2015.800	38	53.047		
Total	2351.244	44			

Source: Elaborated by authors (2023).

3.4 Post Hoc Test (with LSD Test)

Specifically, the One-Way ANOVA test does not tell us whether or not the level of the CK major was the same as the level of the AK major, only that there are significant differences in the response variables (the seven sub-indicators of Understanding of Technological Andragogical Content Knowledge) due to variables or factors. A post hoc or post hoc test may be run to determine which component levels are significantly different. To determine whether there was a statistically significant difference between each sub-indicator using the LSD post hoc test, it can be seen in Table 4.

Table 4 - Multiple comparison results

(I) Understanding Indicator		(J) Understanding Indicator		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
	CK		AK	-6.635	3.705	.081	-14.14	.87
			TK	-4.569	3.459	.194	-11.57	2.43
			ACK	-3.902	4.561	.398	-13.14	5.33
			TCK	3.431	4.561	.456	-5.80	12.66
			TAK	.765	4.561	.868	-8.47	10.00
			ACK	-2.360	3.123	.454	-8.68	3.96
	AK		CK	6.635	3.705	.081	-.87	14.14
			TK	2.067	4.410	.642	-6.86	10.99
			ACK	2.733	5.319	.610	-8.03	13.50
			TCK	10.067	5.319	.066	-.70	20.83
			TAK	7.400	5.319	.172	-3.37	18.17
			ACK	4.275	4.152	.310	-4.13	12.68
	TK		CK	4.569	3.459	.194	-2.43	11.57
			AK	-2.067	4.410	.642	-10.99	6.86
			ACK	.667	5.150	.898	-9.76	11.09
			TCK	8.000	5.150	.129	-2.43	18.43
			TAK	5.333	5.150	.307	-5.09	15.76
			ACK	2.208	3.933	.578	-5.75	10.17
	ACK		CK	3.902	4.561	.398	-5.33	13.14
			AK	-2.733	5.319	.610	-13.50	8.03
			TK	-.667	5.150	.898	-11.09	9.76
			TCK	7.333	5.947	.225	-4.71	19.37
			TAK	4.667	5.947	.437	-7.37	16.71
			ACK	1.542	4.931	.756	-8.44	11.52
	TCK		CK	-3.431	4.561	.456	-12.66	5.80
			AK	-10.067	5.319	.066	-20.83	.70
			TK	-8.000	5.150	.129	-18.43	2.43
			ACK	-7.333	5.947	.225	-19.37	4.71
			TAK	-2.667	5.947	.656	-14.71	9.37
			ACK	-5.792	4.931	.247	-15.77	4.19
	TAK		CK	-.765	4.561	.868	-10.00	8.47
			AK	-7.400	5.319	.172	-18.17	3.37
			TK	-5.333	5.150	.307	-15.76	5.09
			ACK	-4.667	5.947	.437	-16.71	7.37
			TCK	2.667	5.947	.656	-9.37	14.71
			ACK	-3.125	4.931	.530	-13.11	6.86
	ACK		CK	2.360	3.123	.454	-3.96	8.68
			AK	-4.275	4.152	.310	-12.68	4.13
			TK	-2.208	3.933	.578	-10.17	5.75
			ACK	-1.542	4.931	.756	-11.52	8.44
			TCK	5.792	4.931	.247	-4.19	15.77
			TAK	3.125	4.931	.530	-6.86	13.11

Source: Elaborated by authors (2023).

Table 5 - Summary of post hoc test

No	Test Difference with LSD Test			Mean Difference	Sig (p)	Sig. α	Results
1	CK	↔	AK	6.635	0.081	0.05	Not Significant Difference
2	CK	↔	TK	4.569	0.194	0.05	Not Significant Difference
3	CK	↔	ACK	3.902	0.398	0.05	Not Significant Difference
4	CK	↔	TCK	3.431	0.456	0.05	Not Significant Difference
5	CK	↔	TAK	0.765	0.868	0.05	Not Significant Difference
6	CK	↔	TACK	2.36	0.454	0.05	Not Significant Difference
7	AK	↔	TK	2.067	0.642	0.05	Not Significant Difference
8	AK	↔	ACK	2.733	0.610	0.05	Not Significant Difference
9	AK	↔	TCK	10.067	0.066	0.05	Not Significant Difference
10	AK	↔	TAK	7.4	0.172	0.05	Not Significant Difference
11	AK	↔	TACK	4.275	0.310	0.05	Not Significant Difference
12	TK	↔	ACK	0.667	0.898	0.05	Not Significant Difference
13	TK	↔	TCK	8	0.129	0.05	Not Significant Difference
14	TK	↔	TAK	5.333	0.307	0.05	Not Significant Difference
15	TK	↔	TACK	2.208	0.578	0.05	Not Significant Difference
16	ACK	↔	TCK	7.333	0.225	0.05	Not Significant Difference
17	ACK	↔	TAK	4.667	0.437	0.05	Not Significant Difference
18	ACK	↔	TACK	1.542	0.756	0.05	Not Significant Difference
19	TCK	↔	TAK	2.667	0.656	0.05	Not Significant Difference
20	TCK	↔	TACK	5.792	0.247	0.05	Not Significant Difference
21	TAK	↔	TACK	3.125	0.530	0.05	Not Significant Difference

Source: Elaborated by authors (2023).

According to the results of the Post Hoc test in Table 5, it has been concluded that:

•Test results for different understandings of CK and AK obtained an average difference of 6.635 with a Sig. was to 0.081 > 0.05, there was no significant difference in learning outcomes between students' understanding of CK and AK.

•Test results for a different understanding of CK and TK obtained an average difference of 4.569 with a Sig. of 0.194 > 0.05, so there was no significant difference in learning outcomes between students' understanding of CK and TK.

•Test results for a different understanding of CK and ACK obtained an average difference of 3.902 with a Sig. was to 0.398 > 0.05, there was no significant difference in learning outcomes between students' understanding of CK and ACK.

•Test results for a different understanding of CK and TCK obtained an average difference of 3.431 with a Sig. was to 0.456 > 0.05, so there was no significant difference in learning outcomes between students' understanding of CK and TCK.

•Test results for a different understanding of CK and TAK obtained an average difference of 0.765 with a Sig. was to 0.868 > 0.05, there was no significant difference in learning outcomes between students' understanding of CK and TAK.

•Test results for a different understanding of CK and TACK obtained an average difference of 2.36 with a Sig. of 0.454 > 0.05, then there was no significant difference in learning outcomes between students' understanding of CK and TACK.

•Test results for a different understanding of AK and TK obtained an average difference of 2.067 with a Sig. of 0.642 > 0.05, so there was no significant difference in learning outcomes between students' understanding of AK and TK.

•Test results for a different understanding of AK and ACK obtained an average difference of 2.733 with a Sig. of 0.610 > 0.05, so there was no significant difference in learning outcomes between students' understanding of AK and ACK.

•Test results for a different understanding of AK and TCK obtained an average difference of 10.067 with a Sig. of 0.066 > 0.05; there was no significant difference in learning outcomes between students' understanding of AK and TCK.

•Test results for a different understanding of AK and TAK obtained an average difference of 7.4 with a Sig. was to 0.172 > 0.05, there was no significant difference in learning outcomes between students' understanding of AK and TAK.

•Test results for a different understanding of AK and TACK obtained an average difference of 4.275 with a Sig. was to 0.310 > 0.05, then there was no significant difference in learning outcomes between students' understanding of AK and TACK.

•The TK understanding difference test results with ACK obtained an average difference of 0.667 with a Sig. was to 0.898 > 0.05, then there was no significant difference in learning outcomes between students' understanding of TK and ACK.

•The TK understanding difference test results with TCK obtained an average difference of 8 with a Sig. of 0.129 > 0.05, so there was no significant difference in learning outcomes between students' understanding of TK and TCK.

•The TK understanding difference test results with TAK obtained an average difference of 5.333 with a Sig. was to 0.307 > 0.05, then there was no significant difference in learning outcomes between students' understanding of TK and TAK.

•The Different TK understanding test results with TACK obtained an average difference of 2.208 with a Sig. was to 0.578 > 0.05, there was no significant difference in learning outcomes between students' understanding of TK and TACK.

•Test results for a different understanding of ACK and TCK obtained an average difference of 7.333 with a Sig. was to 0.225 > 0.05, then there was no significant difference in learning outcomes between students' understanding of ACK and TCK.

•Test results for a different understanding of ACK and TAK obtained an average difference of 4.667 with a Sig. was to 0.437 > 0.05, there was no significant difference in learning outcomes between students' understanding of ACK and TAK.

•Test results for a different understanding of ACK and TACK obtained an average difference of 6.635 with a Sig. was to 0.081 > 0.05, then there was no significant difference in learning outcomes between students' understanding of ACK and TACK.

•Test results for a different understanding of TCK and TAK obtained an average difference of 2.667 with a Sig. of 0.656 > 0.05, so there was no significant difference in learning outcomes between students' understanding of TCK and TAK.

•Test results for a different understanding of TCK and TACK obtained an average difference of 5.792 with a Sig. was to 0.247 > 0.05, there was no significant difference in learning outcomes between students' understanding of TCK and TACK.

•Test results for a different understanding of TAK and TACK obtained an average difference of 6.635 with a Sig. was to 0.081 > 0.05, then there was no significant difference in learning outcomes between students' understanding of TAK and TACK.

According to the findings of the Post Hoc Tests Multiple Comparisons, the seven sub-indicators of Comprehension Regarding Technological Andragogical Content Knowledge did not have a significant value. This conclusion was reached based on the findings. This was in line with the information gleaned from the survey responses about the seven different sub-indicators of understanding Technological Andragogical Content Knowledge.

4 DISCUSSION

Research in technology-assisted cognition has shown that preparing educators to use technology in the classroom is a challenging endeavour, especially when considering students' unique characteristics. It requires making use of a wide range of pedagogical expertise (Aldhafeeri; Alotaibi, 2022). The findings of this research showed that in-service adult instructors dramatically improved their TACK after incorporating a Blended learning system into a TACK intervention program. This research found that educators might benefit from the TACK intervention more if they used blended learning as a cognitively-facilitated, mechanistic instrument for professional development (Mwangu; Sibanda, 2017). This encouraging result can be further explained by the fact that the Blended learning approach is a significantly process-based method of TACK development. Blended learning resources are an efficient way educators can enhance their teaching competencies using technological tools (Ampera; Chalid, 2021; Hamzah *et al*., 2021). Blended learning, in which students are given individualized recommendations and aids depending on their current academic standing, interests, and other factors, has also been called a game-changer in the classroom (Alamri; Watson; Watson, 2021). The use of blended learning also shows great potential for boosting instructors' professional learning performance and assisting them in developing their instructional abilities (Chaipidech *et al*., 2021). This study's empirical conclusion on instructor`s TACK development aligns with other research suggesting that the Blended learning strategy has great potential for future TACK-based professional learning enabled by data analytics (Filiz; Kurt, 2022).

Additionally, with adaptive operations and systems, blended learning might be helpful for career advancement (Carneiro *et al*., 2018; Oliveira; Jorente, 2019; Goos *et al*., 2020). Furthermore, this is in line with the findings of Anthony *et al.* (2019), who discovered that blended learning has a constructive effect on the professional growth of instructors. Ashraf, Tsegay and Meija (2021) reported encouraging findings for developing a Blended learning environment regarding instructors` various learning styles and TACK issues. The setting mentioned above could significantly enhance instructors' learning outcomes regarding TACK-related knowledge.

Andragogical principles and practices that emphasize teamwork, classroom application, and evidence-based decision-making in terms of Technological Andragogical Content Knowledge (TACK) were highlighted by Bowling and Henschke (2020). The trainees were remarkably engaged in the suggested TACK intervention, acquiring active

and collaborative learning experiences as adults, focusing on the importance of experience and learning orientation. They were able to build on their prior experiences in the classroom to acquire new, crucial information and abilities throughout the sessions. They were also given training exercises for immediate use in the TACK intervention rather than for future use, and the information they gained was explicitly geared toward problem-oriented, real-world scenarios. Our findings are in line with those of other research that points to the importance of active learning and teamwork in TACK for adults' professional development (Kaya; Adiguzel, 2021; Liao *et al*., 2021; Urbina; Statti, 2022; Yurtseven Avci; O'Dwyer; Lawson, 2020). So, the researchers believe it is crucial to apply andragogical concepts and methods when designing professional learning experiences for instructors to foster higher-quality blended learning for TACK growth. Based on the results and methodology of this research, a Blended learning system for educational applications as an intelligence tutor (Castro, 2019) for TACK may provide an alternate means of guiding educators. In addition, continuing education for educators is crucial to retaining a competent teaching staff in the twenty-first century. Adult students may get the help they need to advance their careers via blended learning. This investigation has the potential to serve as a case study of the integration of blended learning with adult learning theory. Blended learning, as it is used in this research, has the potential to serve as a new, cutting-edge infrastructure for the professional and academic growth of today's educators.

5 CONCLUSION

Blended learning systems, especially those that take into account andragogical learning assumptions, need to be considered when designing a TACK intervention program for adult instructors grounded on the andragogy theory. This current study provides a fresh viewpoint on how andragogical techniques might benefit from using the Blended Learning approach. Also, the Blended learning system has been critical in establishing a link to design adult active and collaborative learning experiences based on the Role of experience and Orientation to learning assumptions. In order to andragogically integrate digital technologies into their teaching practice in specific integrated scenarios, the findings have revealed positive benefits of the TACK intervention in increasing the professional knowledge of adult instructors, dubbed TACK. This study's findings add to the expanding body of literature on blended learning in teacher education and teacher professional development, which seeks to enhance how adult instructors get specialized professional training to significantly impact

their students' achievements. Unfortunately, there are two significant flaws in this research. First, there was a relatively limited sample size, and all participants came from the areas and school districts in Indonesia that were part of the experiment. In light of this, it is possible that the statistically substantial gains in TACK shown in this research cannot be extrapolated to all instructors in classes. Second, no qualitative research methods were included in the study; the researchers relied only on quantitative methods to determine the efficacy of TACK intervention programs using Blended learning systems. Quantitative and qualitative research approaches should be combined and given equal weight for enhanced encapsulation. They should also be used to assess the impact of the planned TACK intervention and comprehend the evolution of expert knowledge in this area. The researchers acknowledge the need for further study in light of these caveats and provide suggestions on approaching future investigations. To begin, further studies comparing trainees who have and have not received the application of andragogy and the integration of Blended learning systems should be conducted in the future, and these studies should expand to include additional topics. Second, further research employing quantitative and qualitative inquiry approaches is required to study the impact of TACK intervention and the influence of Blended learning systems on TACK development, which will progress the development of TACK intervention and boost its meaningfulness.

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