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# EL PAPEL MEDIADOR DEL COMPROMISO CURRICULAR CON LAS TIC EN LA RELACIÓN ENTRE LA ACTITUD HACIA EL CURRÍCULO Y EL LOGRO ACADÉMICO

*The Mediating Role of Curriculum Engagement ICT in the Relationship between Attitude Toward Curriculum and Academic Achievement*



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## Resumen:

El estudio tiene como objetivo investigar el papel mediador del compromiso curricular con las TIC en la relación entre la actitud hacia el currículo (ATC) y el rendimiento académico. Se realizaron encuestas con 169 estudiantes de cuatro universidades en Indonesia. Los participantes proporcionaron información sobre su ATC, compromiso curricular con las TIC y rendimiento académico. Los datos se analizaron utilizando técnicas estadísticas como Análisis Factorial Confirmatorio (CFA) y Modelado de Ecuaciones Estructurales (SEM). Los resultados mostraron una



correlación positiva entre ATC y compromiso curricular con las TIC, así como entre el compromiso curricular con las TIC y el rendimiento académico. El papel mediador del compromiso curricular con las TIC en la relación entre ATC y rendimiento académico fue respaldado por los datos. Los hallazgos de este estudio tienen importantes implicaciones para educadores, responsables políticos y diseñadores de currículos. Al comprender la interacción entre ATC, compromiso curricular con las TIC y rendimiento académico, los interesados pueden diseñar entornos de aprendizaje efectivos y atractivos que optimicen las experiencias y resultados de aprendizaje de los estudiantes.

**Palabras clave:** *actitud hacia el currículo; compromiso curricular; ICT; rendimiento académico.*

### **Abstract:**

The study aims to investigate the mediating role of curriculum engagement ICT in the relationship between attitude toward curriculum (ATC) and academic achievement. The study conducted surveys with 169 students from four universities in Indonesia. The participants provided information about their ATC, curriculum engagement ICT, and academic achievement. The data was analyzed using statistical techniques such as Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). The results showed that there was a positive correlation between ATC and curriculum engagement ICT, as well as between curriculum engagement ICT and academic achievement. The mediating role of curriculum engagement ICT in the relationship between ATC and academic achievement was supported by the data. The findings of this study have important implications for educators, policymakers, and curriculum designers. By understanding the interplay between ATC, curriculum engagement ICT, and academic achievement, stakeholders can design effective and engaging learning environments that optimize students' learning experiences and outcomes.

**Key Words:** *attitude toward curriculum, academic achievement, curriculum engagement, ICT.*

## **1. Introduction**

In educational settings, the attitude toward curriculum (ATC) plays a crucial role in shaping students' learning experiences and outcomes. In the context of education in Indonesia, the concept of ATC and Information and Communication Technology (ICT) holds particular significance. In Indonesia, the integration of ICT into the school curriculum has undergone significant evolution (Maskur, Suherman, Andari, Dermawan, et al., 2022), reflecting both historical initiatives and current educational strategies. Initially launched in the early 2000s, efforts to incorporate ICT aimed to modernize education through programs like the School Computerization Program, which provided schools, particularly in urban areas, with computers and internet access. Today, Indonesia continues to advance its ICT infrastructure in schools (Shaturaev, 2021), bolstered by national policies emphasizing digital literacy and technology integration across subjects (Abud, 2012). Curriculum reforms now integrate ICT to enhance teaching methodologies (Proctor et al., 2003), foster interactive learning experiences (Toh, 2016), and prepare students for the digital age (Butler et al., 2018). The implementation of an independent curriculum in the Indonesian education system has aimed to provide a more flexible and inclusive learning experience for students (Rasmitadila et al., 2023). However, the success of

this independent curriculum relies not only on its content but also on students' attitudes toward it.

Recently, there has been a growing interest in researching attitudes toward the curriculum (ATC). Austin et al. (2006) investigated the impact of ATC and assessment on behavior. Their study, however, found no significant difference between ATC and assessment regarding behavioral outcomes. Conversely, Wong et al. (2016) discovered that a simulation-enhanced curriculum significantly improved participation in teamwork and communication. Further research by Ferrer et al. (2022) highlighted that positive attitudes toward in the curriculum context of online learning could lead to increased student engagement and motivation. Similarly, a study by Maskur, Suherman, Andari, Sri Anggoro, et al. (2022) demonstrated that integrating innovative teaching methods within the curriculum could foster critical and creative thinking skills among students, ultimately leading to better academic outcomes. Additionally, a study by Chao et al. (2015) showed that students on high education discovered a positive correlation between students' attitudes toward the learning design curriculum and their academic performance, resulting in improved academic performance. These findings highlight the crucial role that ATC play in shaping students' academic success and underscore the need for educators to foster positive perceptions and attitudes toward the curriculum through engaging and innovative teaching practices.

Furthermore, curriculum engagement has been identified as a critical factor in determining students' academic achievement (Qureshi et al., 2021). When students are actively engaged in the curriculum, they are more likely to develop a deeper understanding of the subject matter (Toothaker, 2018), apply critical thinking skills (Ponder et al., 2011), and demonstrate higher academic achievement (Cho et al., 2021; Clark, 2015). Therefore, understanding and promoting curriculum engagement is essential for enhancing students' learning experiences and outcomes.

In recent years, there has been a rapid integration of Information and Communication Technology (ICT) in education. ICT tools and resources, such as computers, tablets, online platforms, and multimedia materials, have become prevalent in classrooms, offering new opportunities for curriculum engagement (Border, 2019; Eady & Lockyer, 2013; Ferri et al., 2020; Matias & Wolf, 2013; Serrano et al., 2019). Cai et al. (2024) discovered that various types of ICT usage have distinct effects on academic performance and mental health. ICT usage influences academic achievement and mental health directly and indirectly, through psychological factors such as self-efficacy and technostress, as well as social factors like social support. Another study by Chen et al. (2024) highlighted that ICT usage, specifically through a digital reading curriculum, affects both academic performance and well-being among adolescent students. With the increasing integration of ICT in education setting, there is a need to explore the potential influence of curriculum engagement ICT on students' academic achievement within the context of the independent curriculum.

Given the increasing integration of ICT in education and its potential influence on curriculum engagement (John, 2015), it is important to investigate the mediating role of curriculum engagement ICT in the relationship between ATC and academic achievement. Cabellos et al. (2024) found that facilitation conditions within the ICT curriculum context mediate the relationship between attitudes and achievement in digital information and communication skills. Understanding how ICT-mediated curriculum engagement influences the association between students' ATC and their academic achievement can provide valuable insights into the complex dynamics of educational processes. It can inform educational practices, curriculum design, and the effective integration of ICT tools and resources to optimize students' learning experiences and outcomes.

While there is existing research on the relationship between ATC and academic achievement, and studies that explore the impact of curriculum engagement on academic outcomes, the specific role of curriculum engagement ICT as a mediator in this relationship remains relatively unexplored. This research gap highlights the need for further investigation into the mediating effects of curriculum engagement ICT on the association between attitude toward curriculum and academic achievement.

By addressing these research gaps, this study aims to provide insights into the interplay between ATC, curriculum engagement ICT, and academic achievement. The findings will contribute to the existing literature and offer practical implications for educators, policymakers, and curriculum designers in their efforts to create effective and engaging learning environments in the digital age.

## **2. Theoretical Framework of the Model**

### **2.1. ATC and Academic Achievement**

Attitude toward curriculum refers to individuals' beliefs, feelings, and perceptions regarding the curriculum implemented in educational settings (Austin et al., 2006; Korhonen et al., 2022; Orafi & Borg, 2009). It encompasses their attitudes toward the content, structure, instructional methods, and overall design of the curriculum (Cronin-Jones, 1991). ATC play a crucial role in students' educational experiences and can significantly impact their academic achievement.

Research has consistently shown a positive relationship between ATC and academic achievement. Students who hold positive attitudes toward the curriculum are more likely to be engaged, motivated, and actively involved in their learning (Nouri, 2016). They demonstrate a higher level of interest and enthusiasm, leading to increased effort and persistence in their academic pursuits. This positive mindset and engagement contribute to improved learning outcomes and academic performance.

Several studies have examined the association between ATC and academic achievement across various subject areas. For example, in a study by Chao et al. (2015) focusing on high school students, it was found that positive correlation between students' learning attitudes in the learning design curriculum and their academic performance, suggesting that a positive attitude toward learning contributed to better achievement outcomes. Similarly, a study by Mohamed & Waheed (2011) found that the majority of the students held a positive attitude towards mathematics. They expressed interest in the subject, perceived its relevance to everyday life, and recognized its importance for future career opportunities. This positive attitude was reflected in their willingness to engage in mathematics-related activities and their motivation to learn and excel in the subject. Effective teaching methods, such as interactive and hands-on approaches in the term of curriculum, were found to enhance students' attitude towards mathematics. Furthermore, research has also indicated that attitude toward curriculum can mediate the relationship between other factors and academic achievement. For instance, a study by Assylzhanova et al. (2022) provides evidence of the positive impact of ICT-enhanced blended learning on elementary school students' achievement in English and their attitudes towards English lessons. The research underscores the importance of integrating ICT tools and resources in the curriculum to enhance language learning outcomes and promote favorable attitudes towards language learning.

To sum up, a positive attitude toward the curriculum is a valuable asset for students, as it fosters a conducive learning environment and promotes academic achievement. Understanding the factors that shape and influence attitudes toward the curriculum can inform educational practices and interventions aimed at enhancing student engagement, motivation, and achievement. By promoting positive attitudes toward the curriculum, educators and policymakers can create an educational environment that nurtures students' growth, fosters their academic success, and prepares them for future endeavors.

## **2.2. Curriculum Engagement ICT and Academic Achievement**

The relationship between curriculum engagement, ICT, and academic achievement has been a topic of interest in educational research. For example, the integration of ICT into the independent curriculum in Indonesia has gained significant attention in recent years. As schools have the autonomy to design their own curriculum, they have the opportunity to incorporate ICT in various ways to enhance teaching and learning processes within of different disciplinary or interdisciplinary subjects within the curriculum (Farida et al., 2022). Schools are now focusing on equipping students with the necessary competencies to navigate and utilize digital technologies effectively (Shelby-Caffey et al., 2014). This includes skills such as information retrieval, digital communication, critical evaluation of online resources, and responsible digital citizenship (Maskur, Suherman, Andari, Anggoro, et al., 2022). By integrating these skills into the curriculum, students are better equipped to succeed in a digitally-driven society.

Studies have examined how the integration of ICT in the curriculum can enhance students' engagement and ultimately impact their academic achievement. Curriculum engagement refers to the active involvement and participation of students in the learning process within a defined curriculum (Peters et al., 2019). It refers to students' emotional, cognitive, and behavioral investment in their learning experiences. When students are engaged in the curriculum, they have higher academic performance and achievement outcomes (Dotterer & Lowe, 2011). ICT plays a significant role in shaping curriculum engagement in learning environment and ICT can shape the future of higher education (Shaikh & Khoja, 2011). By incorporating technology as a tool for enhancing learning experiences and supporting effective teaching practices, which can contribute to increased curriculum engagement (Eady & Lockyer, 2013).

Research has consistently shown the positive impact of ICT-enhanced blended learning on students' achievement and attitudes towards learning. For instance, a study conducted by Suprabha & Subramonian (2021) investigating the engagement and attitude of higher secondary commerce students towards a blended learning environment. The findings of the study revealed the engagement level and attitude of the students towards the blended learning environment.

Another study that higher levels of ICT development and greater usage of ICT tools and resources were associated with higher student achievement in these subjects (Skryabin et al., 2015). The researchers observed that students who had access to advanced ICT resources and utilized them more frequently demonstrated better performance in reading, mathematics, and science assessments. These findings highlight the importance of integrating ICT effectively into educational settings to enhance student learning outcomes. Furthermore, the research by Erdogdu (2022) revealed that ICT usage, such as access to computers and the internet, had a positive impact on academic achievement. Students who had better access to ICT resources tended to perform better academically compared to those with limited access. The study also found that the learning environment, including factors such as teacher-student interaction, classroom organization, and instructional methods, significantly influenced academic achievement.

These studies provide empirical evidence supporting the positive relationship between ICT-enhanced blended learning, curriculum engagement, and academic achievement. The use of ICT tools and resources in the curriculum can enhance students' motivation, active participation, and access to various learning opportunities.

### **2.3. Curriculum Engagement ICT as a Mediator of Relationship between ATC and Academic Achievement**

As we discussed earlier, some study suggested that the ICT in learning curriculum was associated with academic achievement. It serves as a bridge that connects students' ATC skills with their academic performance (Maskur, Suherman, Andari, Dermawan, et al., 2022), creating a pathway for them to effectively utilize

assistive technologies to support their learning and ultimately improve their academic success (Comi et al., 2017). ICT practices and the integration of technology in the teaching methods impact students' academic outcomes (Lawrence & Tar, 2018). ICT integration in education can impact on the attitudes and beliefs towards ICT, as well as skills and competencies. At the same time, Qaddumi et al. (2021) the participants reported that ICT tools and resources enhance student engagement and motivation, facilitate collaborative learning, and improve academic performance. Therefore, in the present research, we proposed that curriculum engagement ICT can mediate ATC and academic achievements.

The integration of Information and Communication Technology (ICT) in the curriculum has been associated with various impacts on students' academic achievement. Research suggests that ICT integration in education can positively influence academic outcomes, student engagement, motivation, and collaborative learning (Ghavifekr & Rosdy, 2015). However, the relationship between ICT use and academic achievement is complex and inconclusive, with some studies showing positive results in certain curricular areas while others showing little improvement in performance (Valverde-Berrocoso et al., 2022). The Ministry of Education emphasizes the importance of technology-based teaching and learning in the national curriculum, highlighting the role of teachers in utilizing ICT to provide a dynamic and proactive teaching-learning environment (Ghavifekr & Rosdy, 2015). Overall, while ICT integration in the curriculum is believed to have the potential to enhance student learning and academic success, further research is needed to fully understand its impact on academic achievement (Valverde-Berrocoso et al., 2022).

The study by Maskur, Suherman, Andari, Dermawan, et al. (2022) suggests that ICT in learning curriculum is associated with academic achievement, serving as a bridge that connects students' ATC skills with their academic performance. Additionally, Comi et al. (2017) propose that ICT practices and the integration of technology in teaching methods impact students' academic outcomes. Lawrence & Tar (2018) also support this view, stating that ICT integration in education can impact attitudes and beliefs towards ICT, as well as skills and competencies. Furthermore, Qaddumi et al. (2021) found that ICT tools and resources enhance student engagement and motivation, facilitate collaborative learning, and improve academic performance. At the same times, there is positive attitude toward the integration of the ICT (García & Villardón, 2018).

The study by Skryabin et al. (2015) analyzed the effects of ICT integration and ICT use at home and at school on mathematics, reading, and science scores. The results showed a positive correlation between test scores and the level of development of ICT integration and ICT use at home, while they found negative correlations between ICT use at school and academic performance. However, the research on the relationship between ICT use and academic achievement is inconclusive, and more studies are needed to fully understand this complex relationship.

The integration of technology into the curriculum provides instructors with an opportunity to enhance student engagement and academic success. While technology shifts the learning environment to being more student-centered, instructors play an integral role in guiding understanding, offering assistance, and ensuring that students are reaching their learning goals. Overall, students and teachers have positive attitudes towards technology integration and feel that it has positive impacts on learner satisfaction, promotes engagement, and facilitates academic success.

#### 2.4. Research aims and hypothesis model

As previously indicated, prior research has indicated the significance of curriculum engagement in ICT and ATC in relation to academic performance. In this study, our primary objective is to investigate the mediating role of curriculum engagement ICT in the relationship between ATC and academic achievement. The conceptual framework of our proposed model is depicted in Figure 1. Our investigation is guided by the following hypothesis:

H1: ATC is to be expected positively associated with academic achievement.

H2: Curriculum engagement ICT is to be expected positively associated with academic achievement.

H3: Curriculum engagement ICT mediated the association between ATC and academic achievement.

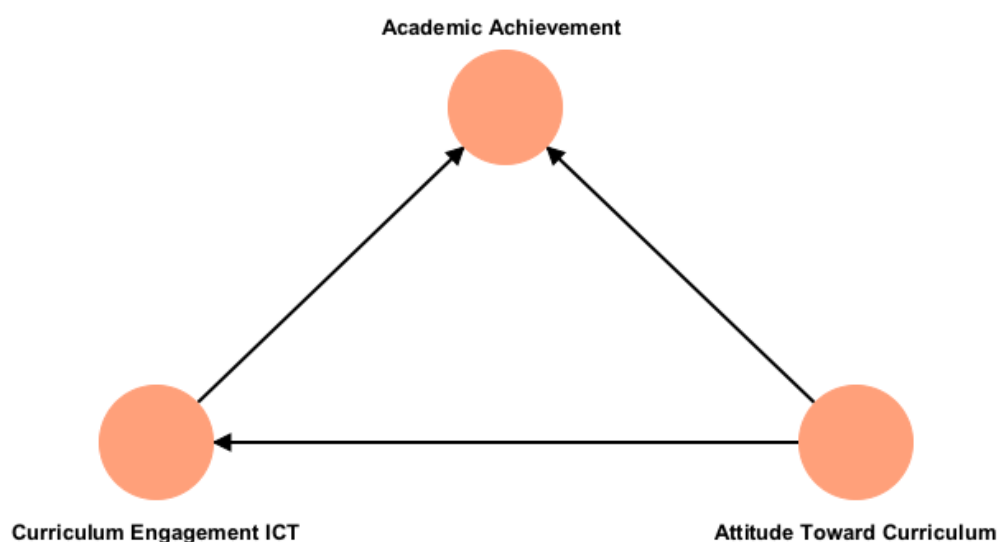


Figure 1. The Hypothesis of the role of curriculum engagement ICT as mediator relationship ATC and academic achievement.

Source: Authors modification based on the literatura framework



### 3. Method

#### 3.1. Participants

The participants in this study were selected from four universities in Indonesia. A total of 169 students took part, with their mean age being  $M = 18.76$  years and a  $SD = 0.59$ . The majority of the participants in this study identified themselves as belonging to the Javanese ethnic group, accounting for 65.1% of the total sample. The Lampung ethnic group constituted 18.9% of the participants. The distribution of participants across the universities is presented in Table 1.

Table 1  
*The distribution of the participants.*

	Characteristics	N	Frequency (%)
Gender	Female	73	43.2
	Male	96	56.8
Type Campus	Private	93	55.0
	Public	76	45.0
Age	18 years	54	32.0
	19 years	101	59.8
	20 years	14	8.3

#### 3.2. Instruments

Curriculum Engagement ICT. We selected 7 items from the ICT during lessons questionnaire developed by Arrosagaray dkk. (2019). For instance, “I concentrate more on what I am learning” and “ICT improve the atmosphere in class”. The response options used a 5-point Likert scale ranging from strongly agree (scored as 5) to strongly disagree (scored as 1). We ensured the validity of our study by conducting a Confirmatory Factor Analysis (CFA) using a maximum likelihood parameter estimate method. The findings, presented in Table 2, indicate that the model used for the curriculum engagement ICT instrument was well-fitting, with a Comparative Fit Index (CFI) of 0.89, Tucker-Lewis Index (TLI) of 0.85, Root Mean Square Error of Approximation (RMSEA) of 0.04, and Standardized Root Mean Square Residual (SRMR) of 0.05. Furthermore, the Cronbach’s alpha values ( $\alpha = 0.91$ ) demonstrated that our instruments exhibited good internal consistency, indicating that the items within the instrument were strongly correlated with each other. In this study, we performed the reliability and validity of the instrument.

ATC. We dropped 21 items developed by Thura & Khaing (2020). The ATC component consists of three scales: attitude in curriculum (e.g., “The curriculum should provide, mainly, a good general education for all students”), practices in curriculum (e.g., “The teacher supplants the textbook method of teaching by student activity”), and curriculum belonging (e.g., “New Curriculum can support students to understand the higher education curricular goals”). These items were used a 5-point Likert scale ranging from strongly agree (scored as 5) to strongly disagree (scored as

1). We found the fit model instruments, CFI = 0.83, TLI = 0.80, RMSEA = 0.03, SRMR = 0.06, and reliability value of 0.95 ( $\alpha = 0.95$ ). Again, we evaluated the validity and reliability of the questionnaire.

Academic achievement. The data pertaining to academic achievement was obtained through students' self-reports regarding their performance in the curriculum assessments, specifically their scores on the most recent tests. The scores provided by the students fall within the range of 1 to 100. Again, we calculated the fit of the data based on the reliability and validity measurement.

Table 2  
*Model fit of the instruments in previous study.*

Variables	CFI	TLI	RMSEA	SRMR	Crb.Alpha
Curriculum engagement ICT	.89	.85	.04	.05	.91
ATC	.83	.80	.03	.06	.95
ICT	.86	.87	.04	.05	1.0

### 3.3. Design and data analysis

The research consisted of three stages. The first stage involved the translation of the original English questionnaire by experts, which was validated by Ph.D. experts from the UK, Japan, and Hungary.

The second stage involved the distribution of the questionnaire to college students at the research site. The final stage focused on analyzing the questionnaire results and addressing the research questions using the Rasch model analysis. Data analysis was conducted using SPSS Version 26 and Smart PLS 4.

In the last stage, we assessed the validity and reliability of each questionnaire utilized in the study. SPSS and Smart PLS 4 software versions were employed for this purpose. CFA was conducted to evaluate the construct validity. TLI, CFI, and RMSEA were utilized to assess the goodness of fit of the model. Subsequently, the internal consistency or reliability of each questionnaire was assessed. Descriptive statistical analysis was then conducted to describe the data, including the mean and standard deviation (SD), as well as the correlations between the factors. Finally, the hypothesis model was examined using full structural equation modeling (SEM). The model fit criteria were consistent with those used in the CFA.

## 4. Results

### 4.1. Descriptive statistics and correlation of latent variable

We examined the descriptive statistic of the variables. Table 3 presents the descriptive statistics and correlations for the variables examined in the study. For the variable CICT, the mean score was 29.67 with a SD = 3.91. Furthermore, Regarding the variable ATC, the value was mean score was 89.95, and the SD was 10.28. For the variable ACA, the mean score was 84.74, and SD = 9.78.

The reported from the correlation. There was a strong positive correlation between CICT and ATC, indicated by a correlation coefficient of 0.79 ( $r = 0.79$ ). Additionally, there was a weak positive correlation between CICT and ACA ( $r = 0.11$ ), as well as a weak positive correlation between ATC and ACA ( $r = 0.10$ ).

Table 3  
*Statistic descriptive and correlations.*

Variables	Mean	SD	Min	Max	1	2	3
CICT	29.67	3.91	21	35			
ATC	89.95	10.28	63	105	0.79**		
ACA	84.74	9.78	45	95	0.11	0.10	

Note: CICT = Curriculum engagement ICT, ATC = Attitude toward curriculum, ACA = Academic achievement. \*\* Correlation is significant at the 0.01 level ( $p < 0.001$ ).

### 4.2. Reliability of the instrument

Furthermore, we performed a Confirmatory Factor Analysis (CFA) on the questionnaire to assess the associations between the items and their corresponding latent constructs. The outcomes of this examination are presented in Table 4, offering insights into the loading factors associated with each item within the scale. These loading factors portray the intensity and orientation of the connection between each item and the specific construct it aims to gauge. Through this analysis, we ascertain the measurement model's reliability and validity, affirming the ability of the items to adequately represent the intended constructs.

Table 4  
*Loading factor, construct validity and reliability of the items.*

Variables	Item	Loading Factor	Cronbach Alpha	CR	AVE
Attitude in curriculum (AIC)			.95	.96	.79
AIC1	School officials should make the curriculum, because they are experts.	.42			
AIC2	Curriculum development should be a cooperative enterprise with teacher, research worker, subject matter special list, psychologist, sociologist, philosopher, educator, administrator, pupil and supervisor all making contributions.	.69			

Variables	Item	Loading Factor	Cronbach Alpha	CR	AVE
AIC3	The curriculum should provide, mainly, a good general education for all students.	.69			
AIC4	All curriculums should be made flexible to meet changing needs of all students.	.69			
AIC5	The curriculum should provide pupils the means of evaluating their own progress	.72			
AIC6	Evaluation of the curriculum should be made in terms of the difference it makes in the child's attitude	.63			
AIC7	Measurement of subject matter achievement should, be the chief method, of evaluation.	.58			
Curriculum belonging (CB)			1.0	.97	.84
CB1	New Curriculum can support students to understand the higher education curricular goals.	.85			
CB2	New Curriculum can encourage all aspect involvement in higher education activities.	.82			
CB3	New Curriculum can support students to do well in school.	.76			
CB4	New Curriculum can support student's ability enough to reach higher education academic goals.	.83			
CB5	New Curriculum relates the lessons to students' daily lives.	.79			
CB6	New Curriculum can motivate students to complete challenging exercises that require them to go beyond the instruction.	.82			
CB7	New Curriculum can enhance students to decide their own problem-solving procedures.	.75			
Practices in curriculum (PIC)			.99	.97	.86
PIC1	The teacher supplants the textbook method of teaching by student activity.	.49			
PIC2	Te teacher helps children remember the things they need to remember by giving them experiences that will make the learning meaningful and desirable.	.79			
PIC3	The teacher recognises the importance of cooperation and social integration by allowing communication and mutual help among students.	.71			
PIC4	The teacher appraisee the students. In terms of how well he achieves goals that are within his reach.	.69			
PIC5	The teacher brings all persons involved, including pupils, into making judgments about the progress that has been made.	.68			
PIC6	The teacher studies the cumulative record of each students.	.67			
PIC7	The teacher stresses thinking and	.73			

Variables	Item	Loading Factor	Cronbach Alpha	CR	AVE
	understanding more than memorization.				
Curriculum engagement ICT (ICT)			1.0	.97	.82
ICT1	I concentrate more on what I am learning	.79			
ICT2	I try harder in what I am learning	.86			
ICT3	I feel more independent in my learning	.83			
ICT4	I understand more easily what I'm learning	.73			
ICT5	I remember more easily what I've learnt	.75			
ICT6	ICT improve the atmosphere in class	.72			
ICT7	ICT enable me to work better with other students on tasks	.78			

### 4.3. Discriminant validity of the instrument

A discriminant validity assessment was performed to determine if latent factors demonstrate distinct empirical characteristics from each other (Hair Jr. et al., 2021). The Fornell-Larcker criterion, recommended by Henseler et al. (2015), was utilized for this purpose. Table 4 provides a condensed overview of the results obtained from this analysis.

Table 4  
*Discriminant validity using Fornell-Larcker criterion*

	AIC	CB	ICT	PIC
AIC	.89			
CB	.88	.92		
ICT	.81	.79	.91	
PIC	.98	.89	.83	.93

Table 4 displays squared correlations, where higher values indicate stronger discriminant validity. Notably, AIC and CB show squared correlations of .89 and .92 respectively with themselves, indicating robust distinctiveness within the model. Similarly, ICT demonstrates a squared correlation of .91 with itself, while PIC exhibits the highest squared correlation of .98, underscoring its strong differentiation from the other variables.

### 4.4. SEM Measurement

The model in our study was analyzed using SMART PLS 4 to test our hypothesis (see Fig. 2). Initially, we evaluated the model fit of the hypothesis, and the results indicated a good fit: Chi-square = 171.18, df = 3,  $p < 0.001$ , CFI = 1.00, TLI = 1.00, RMSEA = 0.01, SRMR = .02. Based on these findings, we can conclude that the proposed model effectively explains students' achievement. The model accounted for

62% of the variance between ATC and academic achievement ( $R^2 = .63$ ). Furthermore, ICT and academic achievement were 2.5% ( $R^2 = .025$ )

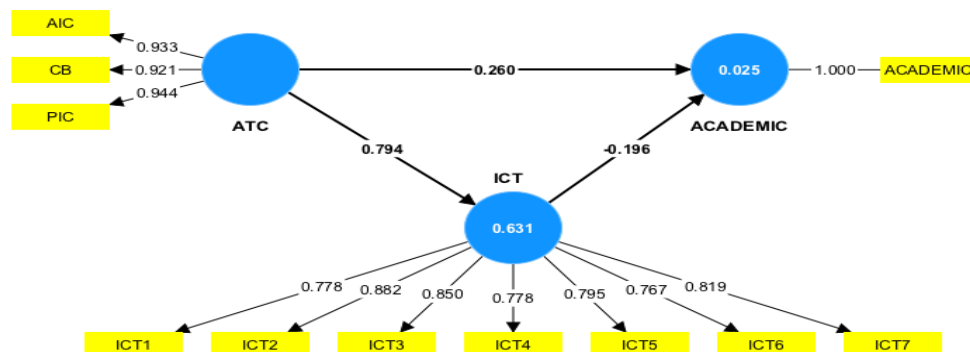


Figure 2. Model fit.

Source: SMART PLS 4 output.

The results of the path analysis revealed significant effects of all model variables on students' achievement. ATC had a positive association with academic achievement ( $\beta = .26$ ,  $p < .001$ ). Furthermore, ATC positively influenced curriculum engagement ICT ( $\beta = .79$ ,  $p < .001$ ). However, curriculum engagement ICT showed a negative association with students' academic achievement, although this relationship was not statistically significant ( $\beta = -.19$ ,  $p > .05$ ).

## 5. Discussion

The unique aspect of this study is the introduction of a novel structural model that explores the relationships among ATC, curriculum engagement ICT, and academic achievement. These specific variables have received limited attention in previous research, making this study a valuable contribution to the existing literature. The inclusion of these variables in the proposed model allows for a comprehensive understanding of their interplay and their potential impact on students' academic outcomes. By investigating these relationships, this research addresses a significant gap in the current knowledge and adds novelty to the field.

The results of our study provide strong evidence for the validity and reliability of our measurement instrument. Through rigorous statistical analysis, we confirmed that the instrument consistently measures what it is intended to measure. The statistical correlations among the variables were thoroughly examined, revealing meaningful relationships that further validate the instrument's effectiveness. The high correlation coefficients between the key variables, particularly between attitudes towards ICT and attitudes towards the curriculum, demonstrate the instrument's ability to capture relevant educational attitudes (Kielblock & Woodcock, 2023). Furthermore, the internal consistency reliability metrics, such as Cronbach's alpha (Taber, 2018), indicated that the instrument is reliable and can be trusted for repeated use in similar studies. Therefore, our findings affirm that the instrument is

both valid and reliable, making it a valuable tool for assessing attitudes and academic performance in educational research (Alkharusi, 2011).

We found that the correlations revealed a strong positive correlation between CICT and ATC. This suggests that as students' attitudes towards ICT improve, their attitudes towards the curriculum also tend to improve significantly. In contrast, there were weak positive correlations between CICT and ACA; and between ATC and ACA, indicating that while there is some relationship between these variables and academic achievement, it is not as pronounced. These findings are consistent with previous research by Assylzhanova et al. (2022), who also found that positive attitudes towards ICT have a beneficial effect on students' academic success. Additionally, Chao et al. (2015) reported a positive correlation between students' attitudes in design curriculum and their academic performance, further supporting the importance of positive attitudes in educational contexts.

The findings of this study are consistent with previous research that has examined the relationship between attitudes toward the curriculum, curriculum engagement, and academic achievement. For instance, Parker & Gerber (2000), conducted a similar study and found that the intervention program was designed to align with or complement the existing science curriculum had a positive impact on both student achievement and attitudes towards science. This supports the notion that a positive attitude toward the curriculum is conducive to better academic outcomes. Additionally, research by Assylzhanova et al. (2022) found a positive impact of students' attitudes toward ICT on their academic achievement. Similarly, Chao et al. (2015) reported a positive correlation between students' attitudes in a design curriculum and their academic performance.

Additionally, the positive association between ATC and curriculum engagement ICT is in line with the findings of a study by Suleimen (2019). The study was that there is a generally positive attitude towards ICT integration among faculty members in higher education institutions. The potential benefits of incorporating ICT tools and resources in the curriculum to enhance teaching and learning experiences. Furthermore, ICT plays a crucial role in effectively instructing mathematics and science within modern classrooms (Jita & Sintema, 2022). This supports the idea that a favorable attitude toward the curriculum can facilitate students' engagement in specific domains, such as ICT, can influence their level of engagement and participation in related learning experiences.

However, the non-significant relationship between curriculum engagement ICT and academic achievement observed in this study contrasts with the findings of a study by Chasanah et al. (2017). Regrettably, these findings diverge from Erdogdu (2022) earlier research, which demonstrated a positive impact of ICT use, including access to computers and the internet, on academic performance. This study, in contrast, found a detrimental association between the level of ICT development and student achievement in reading, mathematics, and science. Furthermore, it supports Karlsson (2022) research, which indicated a negative correlation between frequent computer use and students' academic performance. This means that not all

advancements in ICT development translate to effective integration in classrooms and improvements in students' digital competence (Jeong et al., 2024).

The negative impact of curriculum engagement in ICT on students' achievement may be influenced by several factors. One possible explanation is that excessive focus on ICT-related activities within the curriculum may lead to a reduction in time and attention devoted to other essential subject areas. When students spend an excessive amount of time engaging with ICT, they may have less time available for studying and practicing other academic subjects, which can ultimately affect their overall achievement (Kirschner & Karpinski, 2010; Salomon & Kolikant, 2016). Additionally, the quality of curriculum design and implementation plays a crucial role in determining the impact of ICT on achievement. If the curriculum fails to effectively integrate ICT tools and activities in a meaningful and purposeful way, students may not acquire the necessary knowledge and skills to apply ICT effectively in their learning and academic tasks. This can lead to a disconnect between ICT engagement and actual academic achievement. Furthermore the integration of technology in the curriculum was not solely driven by the availability of technology tools or the content being taught (Harris et al., 2009). Instead, their ability to align technology with instructional goals, and their understanding of how technology could facilitate learning that played a crucial role in shaping the learning activity types.

Furthermore, the negative impact of curriculum engagement in ICT on achievement could also be related to the students' level of self-regulation and time management skills. Excessive engagement with ICT may lead to distractions and reduced focus on academic tasks, resulting in decreased productivity and lower achievement outcomes. It is important to note that the negative association between curriculum engagement in ICT and achievement may not be universally applicable and could vary depending on various contextual factors, such as the quality of ICT integration, instructional strategies, and individual student characteristics. Further research is needed to explore the specific mechanisms and contextual factors that contribute to the observed negative impact on students' achievement in the context of curriculum engagement in ICT.

The findings of this study can be applied in various educational contexts to enhance teaching and learning outcomes. For instance, in K-12 education, schools can design curricula that integrate ICT tools to foster positive attitudes towards both ICT and the curriculum (Tondeur et al., 2007). Interactive digital textbooks and online collaborative projects can engage students more effectively and improve their academic performance (Lee et al., 2023). In higher education, universities can develop specialized courses that combine ICT skills with subject-specific knowledge (Instefjord & Munthe, 2016), such as digital marketing courses that include practical applications like social media analytics. Additionally, personalized learning approaches, such as adaptive learning software and flipped classrooms, can cater to individual student needs and increase engagement. Schools can also use ICT tools for formative assessments, providing real-time feedback and enabling data-driven



decision-making (Webb et al., 2018). Gamification and project-based learning can further enhance student engagement, problem solving, critical and creative thinking skills (Farida et al., 2023; Suherman & Vidákovich, 2024; Supriadi et al., 2024). Ensuring equitable access to technology is vital, especially in rural areas, where schools can implement policies to provide necessary ICT resources and establish community partnerships for additional support.

## 6. Limitation and Future Research

Despite the significant findings and the overall good fit of the proposed model, it is important to acknowledge some limitations of the study. Firstly, the data used in the analysis were based on self-report measures, which may be subject to social desirability bias or recall bias. Future research could incorporate objective measures or multiple sources of data to enhance the reliability of the findings.

Secondly, the study focused on a specific sample or population, and generalizability to other contexts or populations may be limited. It would be valuable to replicate the study with diverse samples from different educational settings to examine the robustness and applicability of the proposed model.

Thirdly, the study mainly examined the direct relationships between variables and did not explore potential mediators or moderators that could further explain the observed associations. Future research could delve into the underlying mechanisms or contextual factors that may influence the relationships between attitude toward curriculum, curriculum engagement ICT, and academic achievement.

Lastly, the study primarily focused on the variables included in the proposed model and did not consider other potential factors that could contribute to academic achievement, such as individual differences, socioeconomic status, or teaching methodologies. Future studies could incorporate a broader range of variables to provide a more comprehensive understanding of the factors influencing academic achievement.

In summary, while this study provides valuable insights into the relationships between attitude toward curriculum, curriculum engagement ICT, and academic achievement, further research is needed to address the aforementioned limitations and expand our knowledge in this area.

## 7. Conclusion

In conclusion, this study examined the relationships between attitude toward curriculum, curriculum engagement ICT, and academic achievement. The findings indicated that attitude toward curriculum had a positive impact on academic achievement, and it also positively influenced curriculum engagement ICT. However,

curriculum engagement ICT did not have a significant direct effect on academic achievement.

The proposed model demonstrated a good fit, and it accounted for a substantial portion of the variance in academic achievement. These results suggest that attitude toward curriculum plays a crucial role in shaping students' academic success.

It is important to note that the study had some limitations, including the use of self-report measures and a specific sample, which may limit the generalizability of the findings. Future research should consider incorporating objective measures, diverse samples, and exploring potential mediators or moderators to further enhance our understanding of these relationships.

Overall, this study highlights the importance of fostering a positive attitude toward curriculum and promoting curriculum engagement ICT in educational settings. By doing so, educators and policymakers can contribute to students' academic achievement and create a conducive learning environment.

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