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# How Technological Self-Efficacy Influences Academic Engagement: The Mediating Role of Learning Motivation Among Vocational Students

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**ABSTRACT**

The development of technology in the digital era requires the readiness of Vocational High School students, especially in the field of technology and information systems, to optimize the use of technology in the learning process. This challenge is related to students' academic engagement, which is influenced by technology self-efficacy and learning motivation. This study aims to analyze the relationship between technology self-efficacy and academic engagement, as well as to examine the mediating role of learning motivation in this relationship. This study employs a non-experimental quantitative approach with a correlational design involving students majoring in Network and Application Information Systems, Computer and Network Engineering, and Software Engineering at SMK X Jakarta. The instruments used include the School Engagement Measure, the Computer User Self-Efficacy Scale, and the Academic Motivation Scale. Data collection was conducted online, and data analysis was carried out using SEM through JASP and SmartPLS software. The results of the analysis show that technology self-efficacy has a significant effect on academic engagement, both directly and indirectly through learning motivation as a partial mediator. These findings confirm that technology self-efficacy and learning motivation are key factors in enhancing the academic engagement of vocational school students. The practical implications of this research encourage schools and educators to design digital-based training and intervention programs aimed at improving technology self-efficacy and learning motivation, so that the academic engagement of vocational school students can be optimized in facing the challenges of the digital-era workforce.

**KEYWORDS** *academic engagement, learning motivation, technology self-efficacy, vocational school students*



## INTRODUCTION

The national education system in Indonesia is regulated by Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System. Formal education is divided into three main levels: primary education, secondary education, and higher education (Article 1, Paragraph 11). Secondary education consists of general secondary education and vocational secondary education (Article 18, Paragraphs 1 and 2), where this research focuses on vocational secondary education or Vocational High School (SMK). The purpose of vocational education is to develop intelligence, knowledge, personality, noble morals, and skills so that students are able to live independently and continue their education in accordance with their vocational field (Ministry of National Education, 2006).

Entering the era of the Industrial Revolution 5.0, the educational paradigm has undergone a fundamental shift. The emphasis is no longer solely on mastering knowledge but also on developing competencies, skills, and character aligned with the demands of the digital era (Patmasari et al., 2023). To address this challenge, the government has established strategic policies such as the 2030 Vocational School Revitalization Roadmap, the development of dual system education, and the integration of technology in learning (Ministry of Education and Culture, 2015; Ministry of Industry, 2024). This transformation requires vocational school students to actively adapt to technological developments and the dynamics of an increasingly complex labor market.

Nevertheless, the realities on the ground show that vocational education still faces significant challenges. The results of the 2022 Programme for International Student Assessment (PISA) placed Indonesia in a low position in reading, mathematics, and science literacy compared to the OECD average (OECD, 2023). The low quality and participation rate in vocational education are exacerbated by limited facilities, a shortage of skilled educators, and a curriculum that is not fully aligned with industry needs (Widaningsih et al., 2024). In addition, the employment absorption rate of graduates remains low, reflecting a competency gap and slow adoption of technology in learning (GIZ, 2024; Ministry of Industry, 2024).

Within the framework of Technical and Vocational Education and Training (TVET), vocational education is expected to prepare competent human resources through practical skills that correspond to industrial needs. The low absorption rate of TVET graduates and the limited use of technology in schools indicate a persistent gap between graduate competencies and industry demands (GIZ, 2024; Ministry of Industry, 2024).

In addition to institutional challenges, vocational school students also face adolescent developmental issues, as this stage is marked by significant psychological, emotional, and social changes. Students often experience academic and career pressures that can lead to psychological problems and decreased learning motivation. Disciplinary issues such as tardiness, truancy, smoking, and low academic motivation and achievement are still common. Furthermore, personal problems such as lack of confidence and difficulty adapting, as well as social issues such as peer conflicts and romantic relationships, can disrupt the learning process (Anwar & Sano, 2024).

These various problems contribute to a general decline in academic performance. One crucial effort to overcome this is to enhance academic engagement in the learning process. Student engagement in school is an important indicator of academic success and psychosocial well-being. According to Fredricks, Blumenfeld, and Paris (2004), low academic achievement, learning fatigue, and high dropout rates are consequences of insufficient student engagement in learning. Similarly found that many students display disengaged behaviors such as apathy, lack of focus, or lack of enthusiasm during lessons.

Conceptually, academic engagement reflects the psychological state of students in responding to the learning process, encompassing cognitive, emotional, behavioral, and social dimensions. This engagement not only influences learning outcomes but also provides a comprehensive and meaningful learning experience (Addinna et al., 2024). Therefore, understanding the factors that enhance academic engagement is crucial in the context of vocational education.

One significant factor influencing academic engagement is technology self-efficacy. Wolverton et al. (2020) assert that students who have high confidence in their ability to use technology tend to be more active and engaged in digital-based learning. However, Arnov et al. (2024) noted that technology integration in vocational schools in Indonesia continues to face challenges, including insufficient teacher training and suboptimal use of technology in assessment, career guidance, and evaluation.

This phenomenon is evident in learning practices at SMK X Jakarta. Before technology integration, many students showed low enthusiasm, grew bored with teacher-centered methods, and some even fell asleep or skipped school. After applying technology-based tools such as multimedia and learning software, students demonstrated increased enthusiasm and interest in learning. Those majoring in Information Systems, Computer and Network Engineering, and Software Engineering have shown higher engagement, likely due to stronger confidence in completing technology-related tasks (Personal Communication, Mr. A., teacher at SMK X Jakarta, March 24, 2025).

However, challenges persist, especially regarding students' comprehension and interest in technology. Some quickly grasp technological concepts and feel confident, while others struggle. Limited access to devices outside of school also hampers students' academic engagement. Difficulties in using technology stem from both limited understanding and lack of self-awareness, indicating that some students still possess low self-efficacy in technology use. Technology self-efficacy plays an important role in influencing academic engagement (Personal Communication, Mr. N., teacher at SMK X Jakarta, March 24, 2025).

Previous research has confirmed that student engagement mediates the relationship between academic self-efficacy and academic outcomes (Putra et al., 2024). Students with high self-efficacy tend to be more behaviorally, emotionally, and cognitively engaged in learning, positively affecting academic performance. The use of digital devices also enables students to be more active in exploring learning resources and participating in online discussions, thereby improving overall understanding and achievement (Fredricks et al., 2004; Kusumo et al., 2024).

Theoretically, the concept of technology self-efficacy is rooted in Bandura's Social Cognitive Theory, which posits that belief in one's own abilities influences behavior and achievement across contexts, including technology-based learning. Research by Pan (2020) and Dinh and Nguyen (2022) further supports that self-efficacy significantly affects students' learning motivation and learning strategies, particularly in interactive digital learning contexts.

However, self-efficacy alone is insufficient. Learning motivation also plays a key role in determining academic engagement (Schunk & DiBenedetto, 2020). Students with high learning motivation tend to be more active, creative, and capable of setting clear academic goals. Conversely, lack of motivation can result in low commitment and suboptimal academic performance.

In technology-based learning contexts, learning motivation determines the extent to which students utilize technology to enhance understanding (Oktapiani et al., 2025). Research by Nurrindar et al. (2021) reveals that learning motivation mediates the relationship between self-efficacy and academic engagement. Pan (2022) emphasizes that learning motivation strengthens the mediating effect between technology self-efficacy and technology-based learning attitudes and behaviors. Likewise, Febriantina et al. (2024) found that learning motivation positively influences students' affective engagement.

The urgency of this research continues to grow alongside the rapid acceleration of technology and digitalization in education, requiring the strengthening of technology self-efficacy and learning motivation to enhance the academic engagement of vocational school students. Theoretically, this study aims to expand understanding of how technology self-efficacy contributes to academic engagement, particularly through the mediating role of learning motivation. Practically, the findings of this study provide evidence-based recommendations for developing training programs, providing infrastructure, and designing technology-based learning strategies that support improved technology self-efficacy and student engagement in vocational education settings.

## RESEARCH METHOD

This study employed a non-experimental quantitative design with a correlational approach to examine the relationships among variables: learning motivation as a mediator, technology self-efficacy as an independent variable, and academic engagement as a dependent variable. The correlational design was chosen based on the research objectives to observe and measure the relationships between variables without manipulation or intervention.

The sampling technique used was purposive sampling, in which participants were selected based on specific criteria relevant to the research objectives. This study was conducted at SMK Negeri X Jakarta, involving students from grades X, XI, and XII. Data collection was carried out using a structured questionnaire distributed online. The questionnaire instrument was developed based on the indicators and measurement scales of each variable under investigation. After distribution to participants, the collected data were analyzed and interpreted to produce the findings discussed in this study.

### Participants

A total of 260 students participated in this study, with an age range of 15 to 18 years. Participants consisted of students in grades X to XII who came from three expertise programs, namely Network and Application Informatics Systems (SIJA), Computer and Network Engineering (TKJ), and Software Engineering (RPL). The students fill out questionnaires designed to measure academic engagement, self-efficacy in the use of technology, and learning motivation. Written approval for student participation in this study was obtained from the homeroom teacher of each department.

**Table 1. Overview of Research Participants Based on Demographic Data**

| Category | Frequency | Percentage |
|---|---|---|
| Gender | | |
| Man | 172 | 66 |
| Woman | 88 | 34 |
| Age (Years) | | |
| 15 | 13 | 5 |
| 16 | 88 | 34 |
| 17 | 107 | 41 |

| Category | Frequency | Percentage |
|---|---|---|
| 18 | 52 | 20 |
| Class | | |
| X | 100 | 38 |
| XI | 95 | 37 |
| XII | 65 | 25 |
| Department | | |
| Software Engineering | 100 | 38 |
| Informatics Systems, Networks and Applications | 95 | 37 |
| Computer and Network Engineering | 65 | 25 |

Based on the results of data collection from 260 respondents, the majority of participants were male students as many as 172 people (66%). Then the most age was 17 years old with a total of 107 people (41%), while based on class level, participants came from class X as many as 100 people (38%) and based on major, the majority of students came from software engineering as many as 100 people (38%).

These findings indicate that the characteristics of the participants are dominated by 17-year-old male students, most of whom are in class X and come from the Department of Software Engineering This distribution pattern is in line with the general trend in vocational schools in the field of technology and information systems, where male students are indeed more interested. This condition is also important to understand the dynamics of learning motivation, self-efficacy in the use of technology, and academic involvement in technology-based vocational education.

**Measurement**

Before the instrument was used in the research, content validity of the School Engagement Measure (SEM) and Computer User Self-Efficacy Scale (CUSE) and Academic Motivation Scale (AMS) instruments was carried out before being used in data collection. Validation is carried out through expert judgment that has been carried out by previous researchers. SEM instruments have been validated in Blumenfeld and Fredricks research (J.Fredrick et al, 2011; J.A. Fredrick & Paris, 2005), CUSE instruments have been validated in the study of Holcomb et al. (2004), based on the previous scale of Cassidy and Eachus, (2002) and the AMS instrument has been validated in the study which have been adapted into Indonesian by (Natalya, 2018).

Academic Engagement is measured using School Engagement Measure (SEM) developed by Fredricks, Blumenfeld, and Paris (Fredricks et al., 2004). The instrument was originally designed to measure student engagement in schools, particularly on a sample of urban neighborhoods, low-income families, black students, and elementary school students in grades 3 through 5. However, in its development, this measuring tool has also been used at higher education levels, such as junior high schools, high schools, and universities.

SEM is a self-report scale (student self-report) which consists of 19 statement items and uses a five-point Likert scale, namely: (1) never, (2) rarely, (3) sometimes, (4) often, and (5) very often. This instrument measures three dimensions of academic engagement, namely behavioral engagement, emotional engagementand cognitive engagement. SEM has demonstrated high reliability with a Cronbach's Alpha coefficient value of 0.835 for the dimensions behavioral engagement, 0.873 for dimensions emotional engagement, and 0.911 for dimensions cognitive engagement. Overall, Cronbach's Alpha value reached 0.947, which indicates that this measuring tool has excellent internal consistency ((Fredricks et al., 2004). Some examples of items are, "I feel good at school," and "I often discuss with friends what I learned in class."

Technology Self-Efficacy is measured using Computer User Self-Efficacy Scale (CUSE) developed by Holcomb et al. (2004), based on the previous scale of Cassidy dan Eachus, (2002). This measuring instrument initially consisted of 30 items, then Holcomb et al. (2004) simplified it into 17 items divided into three dimensions, namely magnitude, strengthand generality. Each item uses a six-point Likert scale, namely: (1) strongly disagree, (2) disagree, (3) somewhat disagree, (4) somewhat agree, (5) agree, and (6) strongly agree. The instrument has good reliability with a Cronbach's Alpha value of 0.866 for dimensions magnitude, 0.919 for strength, and 0.804 for generality. Overall, Cronbach's Alpha value reached 0.947, indicating excellent internal consistency (Holcomb et al., 2004). Some examples of these are, "I feel less confident in my ability to use digital technology in learning", and "Most of the applications used in the department are easy to learn."

Learning Motivation is measured using Academic Motivation Scale (AMS) developed, and has been adapted into Indonesian by (Natalya, 2018). This scale measures three dimensions of motivation, namely intrinsic motivation, extrinsic motivationand amotivation. The short version of the AMS used in this study consisted of 15 statements, each of which was assessed using a six-point Likert scale: (1) strongly disagree, (2) disagree, (3) somewhat disagree, (4) somewhat agree, (5) agree, and (6) strongly agree. The instrument has shown good reliability, with a Cronbach's Alpha value of 0.905 for the dimensions intrinsic motivation, 0.879 for extrinsic motivation, and 0.724 for amotivation. Overall, Cronbach's Alpha value reached 0.942, which indicates that the Indonesian version of AMS has excellent internal consistency (Natalya, 2018). Some examples of such items are, "I enjoy the material during my learning at school," and "I learn because I am happy to be able to complete the assignment well."

**Table 2 . Validity of Technology Self-Efficacy, Academic Engagement and Learning Motivation**

| Variable | Cronbach's Alpha | Composite Reliability (rho_a) | Composite Reliability (rho_c) |
|---|---|---|---|
| Self-Efficacy of Technology | 0.947 | 0.947 | 0.953 |
| Magnitude | 0.866 | 0.866 | 0.903 |
| Strength | 0.919 | 0.919 | 0.933 |
| Generality | 0.804 | 0.804 | 0.884 |
| Academic Involvement | 0.947 | 0.947 | 0.952 |
| Behavioral Engagement | 0.835 | 0.835 | 0.883 |
| Emotional Engagement | 0.911 | 0.912 | 0.928 |
| Cognitive Engagement | 0.873 | 0.874 | 0.904 |
| Learning Motivation | 0.942 | 0.942 | 0.949 |

| Variable | Cronbach's Alpha | Composite Reliability (rho_a) | Composite Reliability (rho_c) |
|---|---|---|---|
| Intrinsic Motivation | 0.905 | 0.905 | 0.924 |
| Extrinsic Motivation | 0.879 | 0.880 | 0.909 |
| Amotivation | 0.724 | 0.725 | 0.879 |

### Procedure

The data collection process in this study began with the preparation of a questionnaire instrument that included all items from the three research variables into one google form format. The questionnaire consists of several parts, namely: (1) Preliminary section containing information about the identity of the researcher, research objectives, research topics, participant criteria, and data confidentiality; (2) An informed consent sheet for the teacher, which must be approved before the participant can continue filling out the questionnaire; (3) The core part of the questionnaire consists of, 17 items that measure the variables of technological self-efficacy, 19 items that measure academic involvement, and 15 items that measure the variables of learning motivation.

The questionnaire was distributed online through Google Form, which students can access using a barcode (QR code) displayed on the classroom projector screen. The students were given ±15 minutes to fill out the questionnaire independently. The data obtained from the results of filling out the questionnaire was then downloaded, documented, and analyzed using JASP and SmartPLS software. The analysis was conducted to test a regression model involving one mediator variable. The results of the analysis are then presented descriptively in the Results and Discussion Chapter.

## RESULT AND DISCUSSION

This study used JASP and SmartPls to conduct normality tests, descriptive statistical data descriptions, correlations between variables, and research hypothesis tests (direct path SEM analysis and indirect effects analysis). Meanwhile, the processing of variable score categories is processed using Microsoft Excel.

The normality test was performed using Shapiro-Wilk, according to a sample count of less than 500 (N = 260). The test results showed that all three variables had a p value of < .05. Thus, it can be concluded that all variables have significantly abnormal data distribution.

**Table 3. Normality test results**

| Variable | Shapiro-Wilk | P-value | Information |
|---|---|---|---|
| Academic Involvement | 0.975 | <0.001 | Abnormal |
| Self-Efficacy of Technology | 0.977 | <0.001 | Abnormal |
| Learning Motivation | 0.971 | <0.001 | Abnormal |

### Overview of Research Data

Statistical descriptive analysis provides an overview of the characteristics of each research variable. The high standard deviation for each variable shows a heterogeneity in students' perceptions and experiences of self-efficacy in technology, academic engagement, and learning motivation.

**Table 4. Descriptive statistics**

| Variable | N | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| **Academic Involvement** | 260 | 19 | 94 | 58 | 18.5 |
| Behavioral Engagement | 260 | 5 | 25 | 15 | 5.2 |
| Emotional Engagement | 260 | 6 | 30 | 18.3 | 6.3 |
| Cognitive Engagement | 260 | 8 | 40 | 24.4 | 8.6 |
| **Self-Efficacy of Technology** | 260 | 17 | 101 | 59.9 | 20.8 |
| Magnitude | 260 | 5 | 30 | 17.8 | 6.7 |
| Strength | 260 | 9 | 54 | 31.6 | 11.6 |
| Generalization | 260 | 3 | 18 | 10.4 | 4.2 |
| **Learning Motivation** | 260 | 15 | 89 | 52.6 | 18.5 |
| Intrinsic Motivation | 260 | 7 | 42 | 24.5 | 9.2 |
| Extrinsic Motivation | 260 | 6 | 36 | 21.2 | 8 |
| Amotivation | 260 | 2 | 12 | 6.8 | 2.8 |

Based on the results of the data distribution on three main variables, namely academic engagement, technological self-efficacy, and learning motivation, the majority of students showed moderate levels in all three. As many as 70% of students had moderate academic engagement, which reflects sufficient participation in the learning process but not optimal, while 63.8% of students had moderate technological self-efficacy, indicating sufficient confidence in the ability to use technology. Similarly, 59.6% of students had a moderate learning motivation, indicating that the learning drive was not yet fully strong. On the other hand, the proportion of students who are in the high category is still relatively low in all three variables, while the low category still needs attention. These findings show the importance of developing educational strategies or interventions that are focused on improving students' self-efficacy and learning motivation to encourage more optimal academic engagement.

**Table 5. Score Range and Number of Subjects Classified as Low, Medium, High**

| Variable | Total Score Range | Categorization | Number of Subjects | Percentage (%) |
|---|---|---|---|---|
| Involvement Academic | $X < 39$ | Low | 45 | 17.3% |
| | $39 \leq X < 77$ | Currently | 182 | 70% |
| | $X > 77$ | High | 33 | 12.7% |
| Self-Efficacy Technology | $X < 39$ | Low | 51 | 19.6% |
| | $39 \leq X < 81$ | Currently | 166 | 63.8% |
| | $X > 81$ | High | 43 | 16.5% |
| Learning Motivation | $X < 34$ | Low | 53 | 20.4% |
| | $34 \leq X < 11$ | Currently | 155 | 59.6% |
| | $X > 71$ | High | 52 | 20% |

### Intervariable Correlation Test

Since the data is not normally distributed, the analysis of the relationships between variables is performed using Spearman correlation. The results of the correlation test showed that all the main variables of the study had a statistically significant positive association ($p<0.001$). Details of the relationships between variables can be seen in the following table:

**Table 6. Spearman Correlation Matrix between Research Variables**

| Variabel | 1 | 2 | 3 |
|---|---|---|---|
| Academic Involvement | - | | |
| Self-Efficacy of Technology | 0.727*** | - | |
| Learning Motivation | 0.688*** | 0.685*** | - |

Based on the results of the analysis in Table 6, all research variables showed a positive and significant relationship. There was a very strong correlation between academic engagement and technology self-efficacy ($r = 0.727$, $p < 0.001$), indicating that individuals with high levels of confidence in technology use tended to have higher academic engagement as well. A strong relationship was also seen between learning motivation and academic engagement ($r = 0.688$, $p < 0.001$), illustrating that the greater the motivation to learn, the more active participation in academic activities became. Meanwhile, the correlation between learning motivation and technology self-efficacy ($r = 0.685$, $p < 0.001$) showed that students with high motivation generally also had good confidence in the use of technology.

**Table 7. Spearman Correlation Matrix Academic Engagement**

| Variable | WITHOUT | BE | EE | THAT |
|---|---|---|---|---|
| WITHOUT | — | | | |
| BE | 0.864*** | — | | |
| EE | 0.898*** | 0.716*** | — | |
| THAT | 0.941*** | 0.726*** | 0.755*** | — |

Based on Table 7, all dimensions of academic engagement—namely SEM (*School Engagement Measure*), BE (*Behavioral Engagement*), EE (*Emotional Engagement*), and CE (*Cognitive Engagement*)—have a very strong positive relationship with each other. The highest correlation was seen between SEM and *Cognitive Engagament* ($r = 0.941$, $p < 0.001$), indicating that social engagement motivation is closely related to students' cognitive engagement. Similarly, a strong positive correlation was found between BE, EE, and CE. These findings confirm that all aspects of academic involvement support each other, so that strengthening in one dimension can help improve the other.

**Table 8. Spearman Correlation Matrix Self-Efficacy Technology**

| Variable | CUSE | M | S | G |
|---|---|---|---|---|
| CUSE | — | | | |
| M | 0.904*** | — | | |
| S | 0.952*** | 0.768*** | — | |
| G | 0.837*** | 0.740*** | 0.711*** | — |

Based on the results of the correlation analysis in Table 8, all dimensions of technology self-efficacy - Computer User Self-Efficacy Scale (CUSE), Magnitude, Strength, and Generality - show a very strong and significant positive relationship. The highest correlation occurred between CUSE and Strength (r = 0.952), suggesting that computer ability is closely related to the strength of an individual's self-confidence. A strong relationship was also seen between CUSE and Magnitude (r = 0.904), as well as between the Generality dimension and the other three dimensions. In general, these findings confirm that each aspect of technological self-efficacy is closely interconnected, so improvements in one aspect are likely to drive improvements in the other. These results can be used as a reference in designing training or interventions to develop technological self-efficacy in students or respondents.

**Table 9. Spearman's Correlation Matrix Learning Motivation**

| Variable | LM | IN | IN | Amot |
|---|---|---|---|---|
| LM | — | | | |
| IN | 0.949*** | — | | |
| IN | 0.926*** | 0.784*** | — | |
| Amot | 0.803*** | 0.716*** | 0.676*** | — |

Based on Spearman's correlation analysis in Table 9, all dimensions of learning motivation – Learning Motivation, Intrinsic Motivation, Extrinsic Motivation, and Amotivation – show very strong and significant positive relationships. The highest correlation was found between Learning Motivation and Intrinsic Motivation (r = 0.949), followed by a strong correlation between Learning Motivation and Extrinsic Motivation (r = 0.926). This means that both intrinsic and extrinsic factors play a role in shaping students' motivation to learn. The relationship between the two types of motivation (r = 0.784) also suggests that they complement each other. Meanwhile, amotivation is also positively correlated with other dimensions, although the value is lower. In general, these results confirm that strengthening one of the motivational dimensions will also increase overall learning motivation, so that it can be the basis for designing interventions to increase students' learning motivation.

**Hypothesis Test**
**Direct Path SEM Analysis**

**Table 10. Direct Effect Analysis Regression Coefficient**

| Predictor | Outcome | Estimate | Std. Error | z-value | p-value | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Self-Efficacy of Technology | Academic Involvement | 0.481 | 0.057 | 8.421 | < 0.001 | 0.375 | 0.588 |
| Learning Motivation | Academic Involvement | 0.358 | 0.058 | 6.202 | < 0.001 | 0.247 | 0.473 |
| Self-Efficacy of Technology | Learning Motivation | 0.686 | 0.034 | 20.100 | < 0.001 | 0.618 | 0.749 |

The results of the Structural Equation Modeling (SEM) analysis showed that **the self-efficacy of technology** had a positive and significant effect on **academic involvement** (β = 0.481, p < 0.001; CI: 0.375–0.588). This means that the higher the self-efficacy in the use of technology, the higher the student involvement in academic activities. In addition, **learning motivation** also had a significant effect on **academic engagement** (β = 0.358, p < 0.001), indicating that motivated students tend to be more active in learning. The self-efficacy of technology also showed a strong influence on **learning motivation** ($\beta = 0.686$, $p < 0.001$), so it can be concluded that confidence in technological capabilities not only increases direct engagement, but also through increased learning motivation.

**Indirect Path Effect**

Figure 1, to find out whether there is an indirect influence of technological self-efficacy on academic engagement through learning motivation as a mediator, a mediation analysis was conducted. The results of the indirect line test can be seen in table 11.

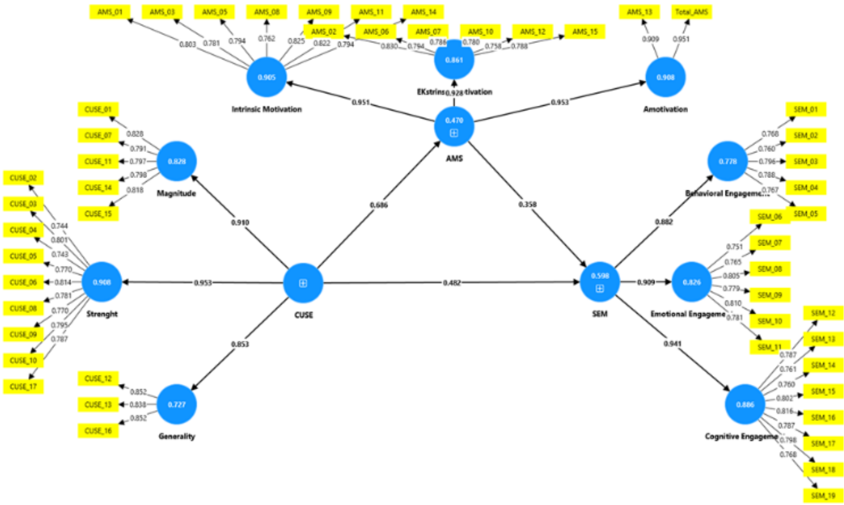


**Figure 1. SEM Analysis of the Mediation Pathway**

**Table 11. Regression Coefficient of Mediation Pathway Analysis**

| Mediation Pathway | Estimate | Std.Error | T-Statistiks | p-value | 95% Confience Interval | |
|---|---|---|---|---|---|---|
| | | | | | Uper | Lower |
| CUSE → AMS → SEM | 0.246 | 0.042 | 5.814 | < 0.001 | 0.167 | 0.334 |

Mediation analysis confirmed that learning motivation (AMS) plays a role as a partial mediator in the relationship between CUSE and SEM. The resulting indirect effect was $\beta = 0.246$ ($p < 0.001$; CI 95% [0.167, 0.334]), with confidence intervals that do not cross zero. These findings indicate that 24.6% of the influence of CUSE on SEM is channeled through increased learning motivation. However, the direct effect of CUSE → SEM that remained significant ($\beta = 0.482$) confirms that learning motivation is not the only connecting pathway. In other words, students' academic involvement is simultaneously influenced by technological confidence (direct effect) and the learning motivation it generates (indirect effect).

The results of this study show that there is a significant relationship between technological self-efficacy, learning motivation, and academic engagement. The direct effect of technological self-efficacy on academic engagement ($\beta = 0.481$, $p < .001$) supports social cognitive theory which emphasizes that self-efficacy is a key factor in shaping and directing individual behavior, including in the context of digital learning. These findings are in line with the research of Gomez-Apaza et al. (2025), which states that academic self-efficacy has an important contribution to improving students' digital skills as well as academic engagement. The study confirms that academic self-efficacy positively contributes to students' active participation, and that both self-efficacy and academic engagement are significant predictors of digital skills achievement. Thus, the higher a person's self-efficacy in the use of technology, the greater the level of academic involvement that is realized.

Another empirical support comes from Getenet et al. (2024), who found that self-efficacy towards technology is positively correlated with all aspects of students' online engagement, including social, collaborative, cognitive, behavioral, and emotional dimensions. The influence of self-efficacy of this technology is also strongly reflected in the motivation to learn; Students with high self-efficacy in the use of technology, especially computers, tend to have higher motivation to adopt and utilize learning technologies, including digital translation applications. In other words, the level of student confidence in their ability to use technology also increases the internal drive to learn and innovate (Li et al., 2024).

Self-study motivation has proven to play an important role in increasing student academic engagement. The results of the study by Vásquez-Palacios et al. (2024) show that learning motivation is the main predictor of student affective engagement, where self-efficacy functions as a mediator that strengthens the relationship between motivation and engagement. This means that students with high learning motivation tend to have better emotional involvement in the learning process, especially when mediated by self-confidence in their academic competence. Similar findings were shown by Acosta-Gonzaga (2023), who emphasized that learning motivation significantly improves all dimensions of academic engagement, ranging from emotional, cognitive, behavioral, to metacognitive, and all of them contribute positively to student academic achievement.

In addition to a direct role, learning motivation is also a partial mediator between technological self-efficacy and academic engagement. This means that students' confidence in their ability to use technology not only has a direct impact on learning engagement, but also has an indirect effect through increased motivation. These findings are in line with the self-determination theory of Deci and Ryan (2000), which explains that motivation is the result of an interaction between an individual's internal capacity and the support of the learning environment. In this case, self-efficacy towards technology is one of the main drivers for the formation of learning motivation which ultimately encourages active student involvement.

In the context of digital or hybrid learning, the role of learning motivation as a mediator is further strengthened by the research of Fardan et al. (2025), which emphasizes that motivation can channel the influence of internal factors such as growth mindset, self-efficacy, and perception of the benefits of AI to students' problem-solving skills. With a strong motivation to learn, students are not only better prepared to face the challenges of digital learning, but also more active, critical, and involved in various academic activities.

Another finding from Almayez et al. (2025) also provides an idea that in online learning, the relationship between motivation, self-efficacy, and academic engagement is getting closer through the application of self-regulated learning strategies. Motivation is not only the main motor of participation, but also strengthens the influence of self-efficacy in directing academic engagement through improving self-regulation skills. Similarly, Oportus Torres et al. (2024) support that the reinforcement of self-regulated learning which is influenced by motivation and technological self-efficacy directly increases student engagement.

On the other hand, recent studies have also expanded the evidence on the significance of self-efficacy and learning motivation in learning practice. Research by Masnawati et al. (2023) shows that students with high self-efficacy in online learning show greater enthusiasm for learning, active participation in discussions, and involvement in sharing knowledge, so that self-efficacy can function as strategic psychological capital. In addition, the implementation of technology-based learning such as TPACK has been proven to be able to increase the effectiveness of learning and the self-efficacy of teachers and students (Joshi, 2023).

Overall, the series of findings confirms that in the context of digital and hybrid learning, technological self-efficacy is a fundamental factor that affects students' academic engagement both directly and indirectly through learning motivation. The practical implications of the results of this study emphasize the importance of a holistic approach in the integration of technology in education, especially in vocational schools: namely strengthening students' self-confidence in the use of technology, developing motivation with strategies based on self-determination theory, and increasing teacher capacity through the TPACK model. The implementation of these three aspects will simultaneously maximize the positive impact of technology on the quality of learning and job readiness of graduates in the digital era.

## CONCLUSION

Based on the results of a study involving 260 vocational school students in the field of technology in Jakarta, it was found that self-efficacy in the use of technology has a significant effect on academic involvement, either directly or through learning motivation that acts as a partial mediator. The three main variables, namely technological self-efficacy, learning motivation, and academic engagement, are positively and significantly interconnected. This finding confirms the importance of students' self-confidence in technological capabilities and intrinsic motivation in supporting participation and activeness in learning in the digital environment. Most of the students were identified as being at a moderate level for these three variables, so strategic steps are needed to strengthen self-efficacy and learning motivation to increase optimal academic engagement. The practical implications of this research encourage schools and educators to design technology-based and motivational programs, such as digital training, project learning, and the application of the TPACK approach, so that vocational school graduates are better prepared to face the demands of the digital era workforce. For further research, it is recommended to use the longitudinal method and consider other external factors, such as social support and learning style, in examining technology-based academic engagement.

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