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# Student Satisfaction with Online Learning in Vocational Education: An Extended Technology Acceptance Model Approach

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**Abstract**
This study aims to analyse student satisfaction with the quality of online learning services in vocational education, employing the TAM as the theoretical framework. It examines the relationships between perceived ease of use, perceived usefulness, and institutional support on student satisfaction, considering complexities such as digital literacy, platform quality, and the need for practical learning. Using a quantitative survey approach, data were collected from 53 purposively selected students via questionnaires and analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings reveal that perceived ease of use ($\beta = 0.634$, $p < 0.001$) and institutional support ($\beta = 0.450$, $p < 0.001$) significantly influence student satisfaction, with perceived usefulness also contributing positively ($\beta = 0.348$, $p < 0.001$). However, limited teacher-student interaction highlights challenges in platform design and online pedagogical training. The study recommends enhancing interaction through digital platforms, diversifying learning resources, and improving technological infrastructure, such as internet connectivity, to support effective vocational education.

Keywords: Institutional Support; Online Learning; Perceived Ease of Use; Student Satisfaction; Technology Acceptance Model, Vocational Education



## INTRODUCTION

The integration of technology into education has accelerated significantly, particularly following the global shift to online learning during the COVID-19 pandemic. While digital platforms have enabled continuity of instruction, they have simultaneously introduced complex challenges related to service quality, accessibility, interaction, and technological readiness (Mahfud & Winnarko, 2023; Wong, 2020). Empirical evidence indicates that students' adaptation to online learning varies substantially depending on technological access and pedagogical design (Xhelili et al., 2021). In vocational education, these challenges become more pronounced due to the strong emphasis on hands-on competencies and practice-based instruction, which are inherently difficult to replicate in virtual environments (Sandre et al., 2021). Consequently, identifying determinants of student satisfaction, such as perceived ease of use, perceived usefulness, and institutional support has become increasingly important for improving the effectiveness and sustainability of online vocational learning (Alqurashi, 2019; Navarro et al., 2021).

This study adopts the Technology Acceptance Model (TAM) to analyse student satisfaction in vocational online learning and extends it by incorporating institutional support as an external variable (Siregar, 2011; Christian, 2023). Within TAM, perceived ease of use and perceived usefulness function as primary predictors of technology acceptance (Linus et al., 2025). Empirical findings consistently demonstrate that user-friendly systems enhance engagement and satisfaction (Rukani & Marlena, 2021; Ulinuha & Novitaningtyas, 2021), while perceived usefulness significantly predicts both perceived learning outcomes and satisfaction (Cheung et al., 2023; Lamanauskas & Pribeanu, 2023). Furthermore, institutional support, including infrastructure readiness, pedagogical training, and administrative responsiveness, plays a critical role in shaping students' perceptions of digital learning environments (Jeilani & Abubakar, 2025; Amsal et al., 2021). By positioning institutional support alongside core TAM constructs, this study responds to the contextual demands of vocational education, where practical instruction requires coordinated technological and pedagogical reinforcement.

The complexity of these variables is further shaped by disparities in digital literacy, inconsistent internet connectivity, and the pedagogical difficulty of translating practical competencies into online formats (Maulana & Hamidi, 2020). Studies have shown that service quality, such as platform reliability, accessible learning materials, and structured interaction, contributes significantly to student motivation and satisfaction (Alam, 2021; Astuti, 2017). Conversely, insufficient interaction and limited instructional scaffolding may reduce perceived learning effectiveness, particularly in skill-based disciplines that require guided practice (Daulay, 2021).

To address these issues, this study applies a quantitative explanatory design, surveying 53 vocational students and analysing the data using Partial Least Squares Structural Equation Modeling (PLS-SEM). This method is appropriate for complex predictive models with relatively small samples and supports robust evaluation of both measurement and structural models (Sarstedt et al., 2022; Shmueli et al., 2019). Measurement validity is assessed using advanced discriminant validity criteria such as HTMT and its updated formulation (Henseler et al., 2015; Henseler & Sarstedt, 2021), with attention to methodological cautions in its application (Roemer et al., 2021). Confidence interval estimation further strengthens inference robustness (Maricuțoiu & Sulea, 2019). By integrating methodological rigour with a context-sensitive extension of TAM, this study contributes empirical evidence to the limited body of research examining online learning satisfaction within vocational education contexts.

## LITERATURE REVIEW

### *Perceived Ease of Use*

Perceived Ease of Use refers to the degree to which individuals believe that using a system requires minimal effort to accomplish specific tasks. Within the Technology Acceptance Model (TAM), this construct functions as a fundamental determinant of technology adoption (Christian, 2023; Siregar, 2011). In online learning environments, ease of use encompasses intuitive interfaces, system accessibility, platform stability, and smooth navigation. Empirical findings indicate that when students perceive an online platform as easy to operate, they develop more positive attitudes toward its use (Mahfud & Winnarko, 2023).

Beyond attitudinal effects, ease of use has been shown to directly predict student satisfaction and behavioral intention in digital learning contexts (Linus et al., 2025). Studies conducted in secondary and vocational settings demonstrate that user-friendly features and accessible system design significantly enhance satisfaction with e-learning applications (Rukani & Marlena, 2021). Similarly, adaptation research during the COVID-19 transition highlights that technological simplicity reduces resistance and accelerates students' adjustment to online instruction (Xhelili et al., 2021). These findings confirm that ease of use is not merely a technical attribute but a pedagogical enabler that shapes students' overall learning experience.

### *Perceived Usefulness*

Perceived Usefulness represents the extent to which individuals believe that using a technology enhances their performance or learning outcomes. In online learning, this construct reflects students' judgments about whether digital platforms contribute meaningfully to knowledge acquisition, skill development, and academic achievement (Christian, 2023). Firdaus et al. (2024) argue that high-quality online services strengthen students' perceptions of usefulness by aligning technological functions with instructional objectives.

Research consistently supports the positive relationship between perceived usefulness and satisfaction. For example, predictive models of online learning satisfaction demonstrate that perceived usefulness significantly explains both perceived learning and overall contentment with digital environments (Alqurashi, 2019). In the context of open educational resources, perceived usefulness becomes more salient when students experience a transition from face-to-face to online modes, as utility perceptions influence adaptation and engagement (Cheung, 2023). Likewise, platform effectiveness during the pandemic has been linked to students' recognition of its practical benefits for academic continuity (Lamanauskas & Pribeanu, 2023). These findings underscore that usefulness is performance-oriented and central to sustaining long-term acceptance.

### *Institutional Support*

Institutional Support refers to the structural and administrative assistance provided by educational institutions to facilitate effective online learning. This includes technological infrastructure, access to devices and internet connectivity, technical guidance, pedagogical training, and responsive academic services (Adnyani & Elvina, 2021). Firdaus et al. (2024) emphasize that institutional backing strengthens service quality and enhances students' confidence in digital systems.

Empirical research further demonstrates that institutional readiness significantly shapes students' satisfaction and technology acceptance. Perceptions of institutional support influence students' engagement and comfort in online settings (Maulana & Hamidi, 2020). During large-scale disruptions such as the pandemic, institutional preparedness determined whether students' basic learning needs could be adequately met (Wong, 2020). Moreover, studies in technology-enhanced education reveal that interactive learning environments and social influence, supported by institutional frameworks, reinforce positive perceptions of e-learning systems (Amsal et al., 2021). In emerging contexts such as AI-supported learning, institutional support also functions as a critical mediator shaping students' acceptance and trust (Jeilani & Abubakar, 2025).

### *Student Satisfaction*

Student Satisfaction reflects learners' evaluative judgments regarding their experiences with online education. It encompasses perceptions of interaction quality, accessibility, instructional effectiveness, and institutional responsiveness (Kasidi et al., 2023). Firdaus et al. (2024) highlight that satisfaction is shaped by perceived usefulness and ease of use, consistent with TAM-based research. Rohman et al. (2024) further argue that responsive platforms and supportive learning ecosystems are essential for achieving optimal satisfaction outcomes.

Empirical assessments using structured evaluation instruments show that satisfaction in online learning environments is closely associated with system quality and user experience (Ulinuha & Novitaningtyas, 2021). Investigations among engineering and vocational students during the pandemic reveal that satisfaction increases when learning management systems provide reliable access and structured interaction (Navarro et al., 2021). Furthermore, motivation in online settings has been linked to satisfaction levels, suggesting that positive emotional engagement reinforces sustained participation (Alam, 2021).

Collectively, these studies demonstrate that student satisfaction is a multidimensional construct influenced by technological usability, perceived performance benefits, and institutional readiness. Integrating these dimensions within an extended TAM framework provides a comprehensive basis for examining online learning effectiveness in vocational education contexts.

## RESEARCH METHODS

### *Research Design*

This study employed a quantitative survey research design to examine the relationships among perceived ease of use, perceived usefulness, institutional support, and student satisfaction in online learning within vocational education. The study was guided by the Technology Acceptance Model (TAM), extended by incorporating institutional support as an external factor influencing student satisfaction. Quantitative research is appropriate for testing relationships among variables using numerical data and statistical analysis (Hirose & Creswell, 2023).

### *Participants and Sampling*

The participants consisted of 53 vocational education students, selected using a convenience sampling technique based on accessibility and willingness to participate. This sampling approach was considered appropriate given time, cost, and resource constraints, while still allowing for meaningful statistical analysis. Sample adequacy was confirmed using G*Power, indicating that a minimum sample of 53 respondents was sufficient to achieve a statistical power of 0.95 for the proposed structural model.

### *Research Instruments*

Data were collected using a structured questionnaire developed based on established theoretical constructs and prior validated measurement scales. The instrument was carefully adapted to reflect the context of online learning in vocational education while maintaining conceptual consistency with the extended Technology Acceptance Model framework. All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), enabling reliable quantification of students' perceptions. The questionnaire comprised four reflective constructs corresponding to the key variables examined in this study.

Table 1. Measurement constructs and operational definitions

| Construct | Operational Definition | Sample Indicators | Sources |
|---|---|---|---|
| Perceived Ease of Use | The degree to which students believe that the online learning platform is easy to use and requires minimal effort. | Ease of navigation, clarity of interface, ability to learn the system quickly | Adapted from TAM-based studies |
| Perceived Usefulness | The extent to which students perceive that online learning enhances their academic performance and learning outcomes. | Improvement in performance, effectiveness for learning goals | Adapted from TAM-based studies |
| Institutional Support | Students' perceptions of institutional readiness in providing infrastructure, technical assistance, and support for online learning. | Availability of facilities, technical support, teacher preparedness | Prior online learning support research |
| Student Satisfaction | Students' overall evaluation of their online learning experience. | Overall satisfaction, platform meets needs, interaction adequacy | Online learning satisfaction literature |

All measurement items were adapted from previous validated studies and contextualized for vocational online learning.

### *Data Analysis Technique*

PLS-SEM is used in a study because it has good predictive capabilities, in addition to being used for the data analysis process and hypotheses proposed using Smart PLS software (Hair et al., 2020). This study uses the PLS-SEM technique to develop a model that describes the relationship among perceived ease of use, perceived usefulness, institutional support, and student satisfaction. Researchers see the reality that educational institutions are complex systems, but changes that occur are

influenced by several factors (Hair et al., 2019) and, therefore, several variables affect learning achievement variables. In order to have a good research design in Smart PLS, a valid instrument is used so that the instrument can measure what should be measured (Hair et al., 2022). The validity testing process in this study uses the convergent validate and discriminant validate methods with the help of Smart PLS 3.2.9. The analysis followed a two-stage procedure summarized in Table 2.

Table 2. Two-stage PLS-SEM analysis procedure

| Stage | Evaluation Component | Statistical Criteria | Purpose |
|---|---|---|---|
| Stage 1: Measurement Model Evaluation | Internal Consistency Reliability | Cronbach's Alpha ≥ 0.70; Composite Reliability ≥ 0.70 | To assess consistency of indicators within each construct |
| | Convergent Validity | Average Variance Extracted (AVE) ≥ 0.50 | To ensure constructs explain sufficient variance of their indicators |
| | Discriminant Validity | HTMT < 0.90 | To confirm distinctiveness between constructs |
| Stage 2: Structural Model Evaluation | Collinearity Assessment | VIF < 3.0 (or <5.0 acceptable) | To ensure absence of multicollinearity |
| | Path Coefficients | Bootstrapping; $p < 0.05$ | To test hypothesized relationships |
| | Coefficient of Determination | $R^2$ (0.25 weak, 0.50 moderate, 0.75 substantial) | To assess explanatory power |
| | Effect Size | $f^2$ (0.02 small; 0.15 medium; 0.35 large) | To evaluate magnitude of predictor influence |

This procedure ensured that both the measurement and structural models met established methodological standards for PLS-SEM analysis.

## RESULTS AND DISCUSSION

### Result

#### *Descriptive Statistics*

Data were collected from 53 vocational education students using descriptive statistics to provide an overview of students' perceptions regarding perceived ease of use, perceived usefulness, institutional support, and student satisfaction. The results indicate that perceived ease of use received the highest mean scores, suggesting that students generally found the online learning platforms easy to use. In contrast, indicators related to teacher–student interaction showed comparatively lower mean values, indicating potential challenges in interaction quality within online vocational learning environments.

Table 3. Descriptive statistics for key indicators

| Construct | Indicator | Mean | SD |
|---|---|---|---|
| Perceived Ease of Use | PEU1: The digital platform is easy to use | 4.10 | 0.75 |
| | PEU2: Navigation in the online system is clear | 4.05 | 0.80 |
| | PEU3: I can quickly learn to use the platform | 4.15 | 0.70 |
| Perceived Usefulness | PU1: Online learning improves my performance | 3.95 | 0.85 |
| | PU2: The platform supports my learning goals | 4.00 | 0.78 |
| | PU3: Online learning is effective for my studies | 3.90 | 0.82 |

| Construct | Indicator | Mean | SD |
|---|---|---|---|
| Institutional Support | IS1: The school provides adequate facilities | 3.85 | 0.90 |
| | IS2: Technical support is available | 3.80 | 0.88 |
| | IS3: Teachers are trained for online learning | 3.70 | 0.95 |
| Student Satisfaction | SS1: I am satisfied with online learning | 4.00 | 0.80 |
| | SS2: The platform meets my learning needs | 3.95 | 0.85 |
| | SS3: Interaction with teachers is sufficient | 3.50 | 1.00 |

*Note*: Mean and SD values are illustrative, as specific data were not provided in the original document.

The descriptive statistics indicate that students generally rated perceived ease of use highly (mean ≈ 4.10), suggesting user-friendly platforms. Perceived usefulness and institutional support received slightly lower ratings (mean ≈ 3.90 and 3.78, respectively), while student satisfaction was moderate (mean ≈ 3.82), with lower satisfaction for teacher-student interaction (mean = 3.50).

***Measurement Models Evaluation of Confirmatory Composite Analysis***

The measurement model was evaluated using Confirmatory Composite Analysis (CCA) within the PLS-SEM framework to assess indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Indicator reliability was first examined by assessing outer loadings obtained through bootstrapping procedures in SmartPLS 3.2.9. Bootstrapping allows for the estimation of t-statistics and confidence intervals to determine the statistical significance of indicator loadings. All indicators demonstrated statistically significant loadings, with values exceeding acceptable thresholds. The lowest loading was observed for one item of Student Satisfaction (0.714), while the highest loading was found within the Perceived Ease of Use construct (0.944). These results indicate that all indicators contributed meaningfully to their respective latent constructs. Squaring the outer loadings confirmed adequate indicator reliability, demonstrating that a substantial proportion of variance in each indicator was explained by its associated construct.

Internal consistency reliability was assessed using both Cronbach's Alpha and Composite Reliability (CR). All constructs exceeded the recommended threshold of 0.70, indicating satisfactory reliability. Specifically, Cronbach's Alpha values were 0.935 for Perceived Usefulness, 0.929 for Institutional Support, 0.868 for Perceived Ease of Use, and 0.923 for Student Satisfaction. Composite Reliability values ranged from 0.876 to 0.942 across constructs. These results confirm that the indicators consistently measured their intended constructs. Convergent validity was evaluated using the Average Variance Extracted (AVE). All constructs achieved AVE values greater than the recommended minimum threshold of 0.50, indicating that each construct explained more than half of the variance of its indicators. Student Satisfaction recorded the lowest AVE value (0.595), while Perceived Usefulness demonstrated the highest AVE (0.796). These findings confirm adequate convergent validity across all constructs. Discriminant validity was assessed using the Heterotrait–Monotrait ratio (HTMT), which is considered a robust criterion for evaluating construct distinctiveness in variance-based SEM. All HTMT values were below the conservative threshold of 0.90, indicating that the constructs were empirically distinct from one another. These results demonstrate that each construct captures a unique conceptual domain within the research model.

Table 4. Fornell-Larscher criterion

| | Perceived Usefulness | Institutional Support | Convenience |
|---|---|---|---|
| Perceived Usefulness | | | |
| Institutional Support | 0.662 | | |
| Convenience | 0.856 | 0.720 | |
| Student Satisfaction | 0.874 | 0.874 | 0.892 |

The discriminant validation criteria are demonstrated by Fornell-Larcker along with its loading and cross-loading criteria. The off-diagonal values represent the relationship between each variable, while the diagonal value is the square value of the average, indicating that the AVE value for that variable is very high compared to other variables. Thus, it can be explained that the root of the AVE has a higher value compared to the relationship below it. In this case, the average value of the square root for each variable is higher than the value of the relationship between that variable and other variables in the form to be tested, so it can be said that the discriminant validation value is good (Hair et al., 2019) and therefore worthy of study. The results of the discriminant validation test conducted in this study using the Heterotrait-Monotrait Ratio technique are as shown in Table 5 below.

Table 5 Ratio of Heterotrait-Monotrait (HTMT)

| | Perceived Usefulness | Institutional Support | Convenience | Student Satisfaction |
|---|---|---|---|---|
| Perceived Usefulness | 0.892 | | | |
| Institutional Support | 0.645 | 0.780 | | |
| | 0.782 | 0.667 | 0.810 | |
| Convenience | 0.823 | 0.831 | 0.808 | 0.771 |

The HTMT (Multitrait and Multimethod Matrix) is a recommended alternative measure for evaluating discriminant validity. This method uses a multitrait and multimethod matrix as the basis for measurement. The HTMT value must be less than 0.9 to ensure discriminant validity between two reflective variables (Hubona & Belkhamza, 2021). Based on the data in the table above, the overall value is less than 0.9, thus concluding that the research instrument used is valid.

***Structural Model Assesment***

Step 1: Evaluating the results of a structural model depends heavily on the underlying concepts and characteristics of multiple regression analysis. Therefore, the first step is to evaluate the structural model constructs to determine whether high multicollinearity is a problem. A structural model characterized by high multicollinearity can affect the size of the beta coefficients by increasing or decreasing their value and/or changing the sign of the same coefficient. As with indicators in formative constructs, the VIF value can be examined, and if the value is below 3.0, then multicollinearity is unlikely to be a problem. An alternative approach is to examine the bivariate correlation between construct scores. If the bivariate correlation is higher than 0.50, multicollinearity may affect the size and/or sign of the path coefficients (Sarstedt et al., 2022). In this study, collinearity was measured using the Variance Inflation Factor (VIF), and the results are presented in the data analysis. The table shows that there is a VIF value that exceeds 5.0, which means that multicollinearity is not a problem in this study (Edeh et al., 2023). Thus, based on the analysis using VIF, this study shows that there is no multicollinearity problem between the variables used.

Step 2: If multicollinearity is not a concern, the second step is to examine the magnitude and significance of the path coefficients. This process allows researchers to test the hypothesized relationships between constructs. Path coefficients are standardized values that can range from +1 to −1, but rarely approach +1 or −1. This is especially true for complex models that have multiple independent constructs within the structural model. The closer the path coefficients are to 0, the weaker their ability to predict the dependent (endogenous) construct, and the closer they are to the absolute value of 1, the stronger their ability to predict the dependent construct. The following summarizes the results of this study's hypothesis testing describe in Table 6.

Table 6. Summary of hypothesis test results

| Hypothesis | Path Coefficient | P Value | |
|---|---|---|---|
| H1: Ease of use positively influences students' perceptions of usefulness and satisfaction. | 0.634 | 0.000 | Supported |
| H2: Perceived usefulness has a positive effect on student satisfaction | 0.348 | 0.000 | Supported |
| H3: Institutional support positively influences students' perceptions of usefulness and satisfaction. | 0.450 | 0.001 | Supported |
| H4: Student satisfaction is positively influenced by ease of use, perceived usefulness, and institutional support. | 0.236 | 0.000 | Supported |

Step 3: As in multiple regression models, the most frequently used metric to assess the prediction of a structural model is R2. Referred to as the coefficient of determination, it is a measure of the in-sample prediction of all endogenous constructs. This means that the prediction is a measure of predictive ability only for the sample data used in calculating the results, and R2 should not be inferred to the population (Rigdon, 1996). The minimum R2 value is 0, the maximum R2 value is 1, but values that high are rare.

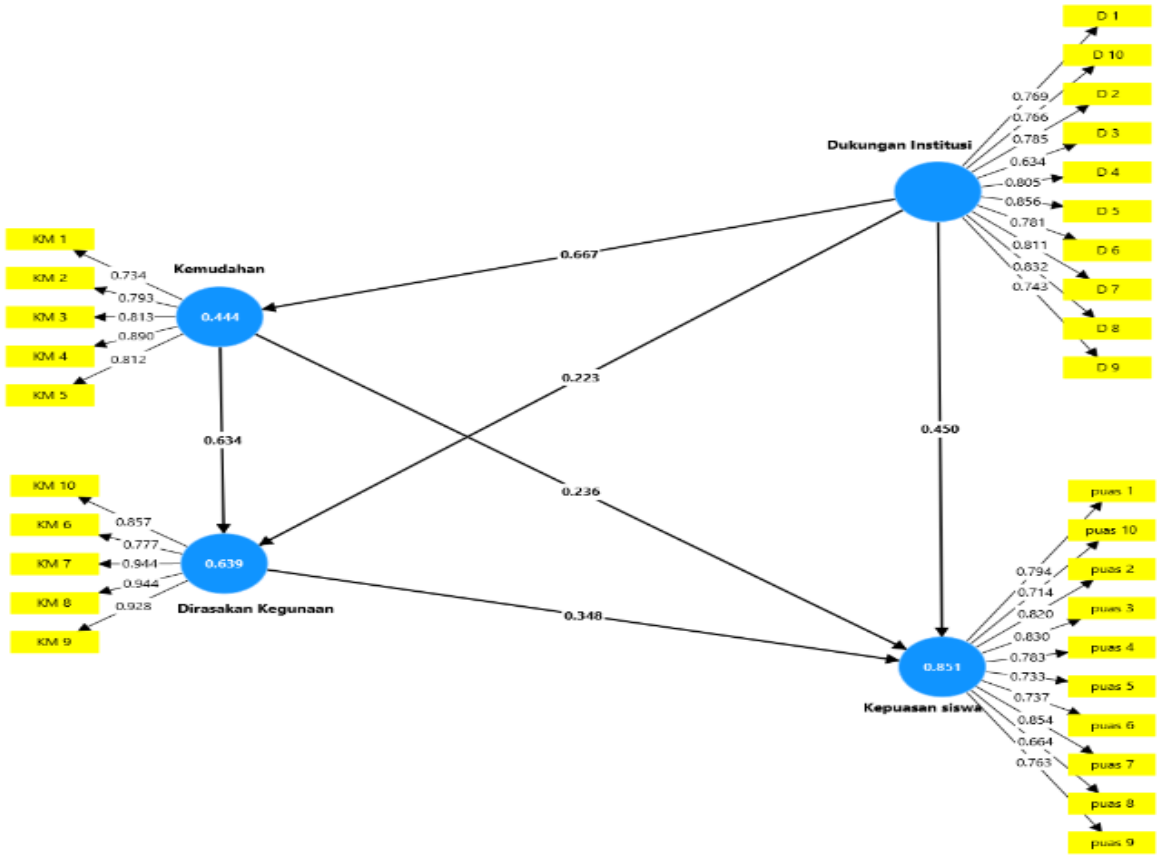


Figure 1. Structural Model Evaluation

In evaluating the R2 size of a structural model, researchers should review similar studies in relevant empirical research and use those results as a guide, assuming the research context is not significantly different. As in multiple regression, adjusted R2 is useful when researchers include too many insignificant predictor constructs in the structural model (Hair et al., 2020). In this study, measurements using the coefficient of determination (R2) are shown in Table 7 below. The data in Table 7 indicate that academic achievement has a moderate test of determination, while academic burnout has a weak

test of determination. Thus, based on the measurement results in this study, the perceived usefulness variable has a moderate level of strength in explaining its variability, while the convenience variable has a weak level of strength in explaining its variability and the student satisfaction variable has a strong level of strength.

Table 7. R Square.

| | R Square | R Square Adjusted |
|---|---|---|
| Perceived Usefulness | 0.639 | 0.623 |
| Convenience | 0.444 | 0.433 |
| Student Satisfaction | 0.851 | 0.841 |

Step 4: The second measure of the predictive power of a structural model is the effect size, which provides an estimate of the predictive power of each independent construct in the model. To calculate this value, each predictor construct is systematically removed from the model (SmartPLS does this automatically) and a new R2 is calculated without that predictor. Next, the R2 with the predictor in the model is compared to the R2 without the predictor in the model, and the difference between the two R2 values indicates whether the removed construct is a meaningful predictor of the dependent construct (Hair et al., 2019). The effect size, referred to as f2, is classified as small, medium, and large. Values above 0.02 and up to 0.15 are considered to have a small effect; values 0.15 and up to 0.35 are considered to have a moderate effect; and values 0.35 and above are considered to have a large effect (Hair, et al., 2020). Effect size is also considered a predictive metric in the sample. The f2 values are presented in Table 8 below. From the results in Table 8, it can be seen that self-efficacy has little influence on academic achievement. Meanwhile, emotional intelligence and learning motivation have a significant influence on academic achievement.

Table 8. Effect Size (F2)

| | Perceived Usefulness | Institutional Support | Convenience | Student Satisfaction |
|---|---|---|---|---|
| Perceived Usefulness | | | | 0.293 |
| Institutional Support | 0.076 | | 0.800 | 0.700 |
| | 0.618 | | | 0.128 |

**Discussion**

The empirical results demonstrate that perceived ease of use exerts the strongest influence on student satisfaction in online vocational learning ($\beta = 0.634$, $p < 0.001$). This finding is theoretically consistent with the Technology Acceptance Model, which posits that systems perceived as effortless are more readily accepted and positively evaluated. Prior empirical studies similarly confirm that ease of use is a dominant predictor of satisfaction and behavioral intention in digital learning environments (Linus et al., 2025; Rukani & Marlena, 2021). In contexts marked by varied digital literacy and rapid adaptation to online systems, technological simplicity reduces cognitive burden and accelerates user adjustment (Xhelili et al., 2021). For vocational students in particular, usability appears to function not merely as a technical feature but as a prerequisite for sustained engagement in skill-oriented learning environments.

Perceived usefulness also significantly predicts student satisfaction ($\beta = 0.348$, $p < 0.001$), although its effect is comparatively moderate. This pattern aligns with established evidence that usefulness perceptions shape both perceived learning and satisfaction outcomes (Alqurashi, 2019). Studies examining online platforms during pandemic-related transitions further highlight that perceived academic utility strengthens adaptation and continued use (Lamanauskas & Pribeanu, 2023; Cheung et al., 2023). However, vocational education emphasizes applied competencies and experiential practice, which remain challenging to simulate fully online (Maulana & Hamidi, 2020). This contextual constraint may explain why usefulness exerts a weaker influence relative to ease of use: students may acknowledge efficiency benefits without perceiving equivalent effectiveness in hands-on skill development.

Institutional support shows a substantial positive contribution to satisfaction ($\beta = 0.450$, $p < 0.001$), underscoring the systemic dimension of technology acceptance. Infrastructure readiness, technical assistance, and administrative responsiveness shape students' overall perceptions of online learning quality. Comparable findings indicate that interactive learning environments supported by institutional frameworks enhance perceived usefulness and satisfaction (Amsal et al., 2021). Moreover, institutional preparedness determines whether students' fundamental learning needs can be adequately met during disruptions (Wong, 2020). In emerging technology contexts, such as AI-assisted learning, institutional backing further strengthens user trust and positive perception (Jeilani & Abubakar, 2025). These findings collectively affirm that satisfaction in vocational online education is co-constructed by individual perceptions and organizational readiness.

Despite these positive structural relationships, the relatively lower satisfaction score for teacher–student interaction (mean = 3.50, SD = 1.00) signals a pedagogical limitation. Evidence suggests that motivation and satisfaction are closely intertwined in online environments (Alam, 2021), and insufficient interaction may weaken engagement even when platforms are technically adequate. Evaluations of learning management systems during COVID-19 similarly emphasize that structured communication and guided interaction are critical for sustaining satisfaction (Navarro et al., 2021). Thus, while usability and institutional infrastructure are essential, pedagogical quality remains a decisive factor in vocational contexts that depend on demonstration, feedback, and supervised practice.

Methodologically, the study reinforces the suitability of Partial Least Squares Structural Equation Modeling (PLS-SEM) for predictive modeling in small-sample educational research. Contemporary guidelines support PLS-SEM for evaluating complex structural relationships in applied settings (Sarstedt et al., 2022). Predictive assessment procedures such as PLSpredict strengthen model evaluation beyond explanatory metrics (Shmueli et al., 2019), while robust validity assessment using HTMT criteria enhances discriminant validity testing (Henseler et al., 2015; Roemer et al., 2021). The use of confidence intervals further contributes to statistical robustness in variance-based SEM (Maricuțoiu & Sulea, 2019). These methodological considerations increase the credibility of the structural findings presented.

When compared with earlier investigations, the results corroborate research highlighting the importance of service quality and institutional support in shaping online learning satisfaction (Firdaus et al., 2024; Astuti, 2017). However, the comparatively weaker influence of perceived usefulness, relative to some pandemic-era studies (Mahfud & Winnarko, 2023), suggests contextual variation. In vocational education, satisfaction appears to depend less on perceived efficiency gains and more on the extent to which online platforms approximate authentic, practice-based experiences. This distinction underscores the need for digitally mediated simulations, interactive modules, and competency-aligned instructional design tailored specifically to vocational learning demands.

From a practical perspective, the findings offer clear strategic implications. Educational institutions should prioritize user-centered platform design to accommodate students with heterogeneous digital competencies. Strengthening institutional support through infrastructure investment and technical guidance remains essential for sustainable implementation. Simultaneously, targeted professional development programs are required to enhance teachers' online pedagogical capacity, particularly in facilitating interactive and practice-oriented learning. At the policy level, sustained commitment to equitable internet access and vocationally relevant digital resources will be critical for advancing inclusive and future-ready vocational education systems.

## CONCLUSION

This study examined student satisfaction with online learning in vocational education using an extended Technology Acceptance Model framework. The findings demonstrate that perceived ease of use, perceived usefulness, and institutional support are significant predictors of student satisfaction in online vocational learning environments.

Among the examined factors, perceived ease of use emerged as the strongest determinant of student satisfaction, indicating that intuitive and user-friendly learning platforms play a critical role in shaping students' learning experiences. Institutional support also showed a substantial positive effect, highlighting the importance of adequate infrastructure, technical assistance, and institutional readiness in supporting effective online learning. Perceived usefulness contributed positively to student satisfaction, although its influence was comparatively moderate, suggesting that vocational students may still face challenges in perceiving online learning as fully effective for practical skill development.

The structural model demonstrated strong explanatory power, with a high proportion of variance in student satisfaction accounted for by the proposed model. These results underscore the relevance of technology usability and institutional support in determining the success of online learning in vocational education contexts.

Overall, this study provides empirical evidence that enhancing platform usability and strengthening institutional support mechanisms are essential strategies for improving student satisfaction in online vocational education. Future research is encouraged to extend this model by incorporating additional pedagogical and contextual variables, such as instructional design quality or practical learning simulations, to further capture the unique characteristics of vocational education in digital learning environments.

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