Assessing the impact of computer-aided drawing on student learning in vocational education

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Abstract

This study assessed the impact of Computer- Aided Drawing on student learning in selected secondary schools in Leyte Division focusing on learners specializing in Technical Drafting. Utilizing descriptive research method and the PLS-SEM approach grounded in a modified Unified Theory of Acceptance and Use of Technology (UTAUT) model. The research aimed to evaluate students' perceptions of CAD, determine the significance of hypothesized relationships, and identify issues and concerns related to CAD usage. A total of Two hundred thirty-three learners participated, most of whom belonged to the adolescent age group and showed a higher representation of female students. The weighted mean was used to determine the respondents' perceptions, as well as the issues and concerns related to the use of Computer-Aided Drawing (CAD). Structural Equation Modeling (SEM) was used to determine the degree of significance of the specified hypotheses. Findings revealed, all constructs received a verbal description of "Agree," suggesting a favorable perception of the CAD system across all key dimensions in the model. For the degree of significance, findings highlight the significant roles of system enjoyment and effort expectancy in influencing behavioral intentions and use behavior, while other relationships and moderating effects were not statistically significant.On the issues and concerns in using Computer- Aided Drawing (CAD), data show that students generally had a very satisfactory experience with CAD in terms of usability, system responsiveness, and productivity. The study therefore concluded that CAD is a highly beneficial and engaging tool for drafting technology students. Recommendations emerging from this study is to enhance Technical Training and Support Programs, Strengthen Infrastructure and Resource Accessibility, and Integrate CAD into Core Curriculum.

Key Words: Assessment, Computer- Aided Drawing, Student learning, PLS- SEM, UTAUT

1. Introduction

Technology is considered vital and dynamic in society. People tend to utilize technology to make society more productive, progressive, and livable. Technology also helps people make their work easier and faster. Moreover, technology does not only bring good to the community or even to industry but also in the field of education (Pepito, 2017). In the quest for a production output in education, one must be creative and animated enough to transmit knowledge towards the learner. It is not enough that the teachers are equipped with knowledge and skills but also utilizing technology in the fullest sense.

Computer-aided design and drafting (CADD) is the process of drafting technical drawing with the use of computer software. It is the technology for design and technical documentation which replaces the manual way of drafting with an automated process. CADD has powerful features in its environment that can help shift teaching and learning from teacher-centered classroom to student-centered classroom, and it is able to create interactive and engaging learning environment for teachers and learners. It also provides tools such as the drawing tools, modifying and editing tools, etc. in its environment that makes drawing faster, consistent, neater and accurate. (Iyarubo, et.al 2023).

Teaching method that has been used so far is more teacher centered. In contrast, the future challenge is learning that emphasizes students' activity in learning (student-centered). Shrank (2005) states that "effective learning is supported by carefully combined media that supports a learner-centered, real-world learning experience " (Inchaurreguie, 2009: 4). He also adds that learning must be able to integrate learning in the classroom with developments in the industry, especially learning to draw with CAD. This opinion is also corroborated by Paliokas (2009: 613) who argued that "the teaching computer aided design (CAD) constitutes a major challenge today.

A study on tracking impact of technology in drafting by Paler,2016 that aims to determine the effects of assimilating technology in drafting, specifically in the use of computer-aided drawing (CAD), it aims to assess the effectiveness of teaching computer-aided drawing and strategy teaching without CAD. The use of CAD was proven to more effective than traditional method, but he recommended that the combination of both strategies using CAD and without the use of CAD can use in teaching drafting. This is supported by Fakhry et.al. (2021), on his study, the result was Educators' and students' were almost the same, showing a preference for using the CAD method compared to the hand drafting method in achieving the working drawing characteristics of accuracy, neatness, pen assignment adjustments, material presentation, ease of modification, saving the drawing for later review, and overall quality. Ozkan et.al (2016) studied Comparison of Conventional and Computer-aided Drafting Methods from the View of Time and Drafting Quality, the respondents were asked to draw a sample of a two-dimensional technical drawing with an interior plan by using the conventional and CAD techniques at different times within a 60-minute period, results found out that no meaningful difference between the decision-making process for choosing the drawing method and perceiving the drawing was made by the students with both methods in the first 5 minutes. At the end of the 60th minute, a huge difference was observed between the conventional and CAD and the CAD was more successful than the conventional drafting. Consequently, the CAD technique has a better outcome from the aspect of time and quality compared to the conventional technique and concluded that CAD has a significant impact on the drafting performances of design students from the aspect of time spent.

Subagio et.al (2019) on his study with 34 students who took Computer Graphic course claimed that the development of CAD drawing learning model using practical learning method reinforced with technical assistance and concept master helped to improve students' learning outcomes, especially in the domain of cognition and psychomotor, and student drawing patterns in CAD competencies must be observed in print and soft file drawing abilities. This study was supported by Malhotra et.al (2000) empirically examines the management of computer aided design (CAD) technology and outcomes of the product design process within manufacturing firms. Particularly in the level of functionality and sophistication of the CAD system are examined with respect to the use of several structural and infrastructural management levers such as the degree of a firm's formalization and decentralization, the extent of the use of teams, the extent of training of CAD designers, and the equity of the incentives within the product design process. The findings indicate that CAD functionality and sophistication are positively related to product design quality, flexibility, and overall performance.

Countries worldwide, including the Philippines, are facing the challenge of adapting their education systems to meet the diverse expectations and demands arising in our complex and interconnected world. Many view the integration of Information Communication Technology (ICT) in education as a potent solution to these challenges. For developing country like the Philippines, given the preparation of skilled manpower, one of the components of the prosperous economy, forms a considerable part of the educational process, education must be seen as an effective social device for creating a modern nation. This explains why societies worldwide allocate substantial investment in resources to prepare and deliver a formal system of education that will help support social and economic development (Tullao 1999; Symaco 2009). This is clear in the Philippines, where the increasing demand for highly trained and sophisticated labor has resulted in the expansion of education. The repositioning of the Philippines basic education for these objectives is apparent, however despite the increasing modernization and internalization of services in education, the perennial but modified issues of quality, access, and equity are present. (Symaco, 2013)

However, despite computer-aided drawing being popular in business world, engineering, architecture, and other related courses in higher education institution, its impact to student learning in basic education remain unexplored. Several studies on CAD focus on the differentiating CAD and traditional method, product development in business sector and using CAD in medical sector while CAD technology is increasingly integrated into the educational setting, there is a gap understanding its specific impact on student learning outcomes such as comprehension, retention, problem-solving skills, and creativity. Additionally, the gap in identifying the effective pedagogical strategies for integrating CAD into educational curricula to maximize its benefits on student learning outcomes. Recognizing the significant role of teaching quality in educational outcomes, various studies have identified factors that significantly influence teaching quality. Therse factors encompass individual characteristics of teachers, psychological characteristics, self-efficacy, teaching motivation, teaching experience, professional development, student composition, student feedback, institutional culture, and institutional resources but despite the extensive research on teaching quality, a holistic assessment factors influencing it remains unexplored. This work aims to address a crucial gap in the literature by analyzing the factors influencing the impact of computer-aided drawing on student learning, aligning the broader discourse on teaching quality in higher education institutions.

Technical drafting is one of the productive subjects that are given to students at Vocational High School. It contains material about knowledge of drawing, reading, and understanding of technical drafting and is carried out in grade 9,10 and 11 using AutoCAD as a supporting application for students. Having only limited computers capable of running CAD is causing significant stress for the teacher who is eager to share their knowledge and skills with Grade 9, 10 and 11 students specializing in technical drafting. For the past years, the researcher has faced challenges in effectively transferring CAD skills to learners due to a lack of computers with the required high specifications necessary for the application.

A Unified Theory of Acceptance and Use of Technology (UTAUT) approach is adopted. It proposes and adds component “Computer Self- Efficacy and System Enjoyment” as additional direct effect of the four key constructs namely performance expectancy, effort expectancy, social influence, and facilitating conditions and the effect of predictors is moderated by age and gender. Still, some key factors, like computer self-efficacy, remained under-researched. Although it was confirmed that this factor plays a role in behavioral intention (Bandura & Locke, 2003), only an indirect effect of self-efficacy on intention was tested while developing UTAUT (Venkatesh et al., 2003). This research adopts the structural equation modelling to examine the adoption of the UTAUT model along with the element of ‘Computer Self- Efficacy and System Enjoyment’. Partial least square-Structural equation modeling helped to analyze the data and support hypotheses or otherwise, however, its application in assessing the impact of computer-aided drawing on student learning, particularly in the context of the Philippines, has yet to be explored in the domain literature. This study aims to provide a comprehensive evaluation of the impact of computer-aided drawing on students' learning outcomes in the Technical Vocational Education – Technical Drafting subject from the perspective of PLS-SEM of the UTAUT model, hence, the contribution of this work is the holistic assessment of the impact of CAD on student learning.

1.2. Purpose and statement of the problem

The purpose of this research is to assess the impact of Computer-Aided Drawing on the selected Secondary Vocational School in Leyte Division, specifically, it answered the following questions:

1. What is the socio-demographic profile of the drafting technology students in selected Secondary Vocational School in Leyte Division in terms of:
    - 1.1. age;
    - 1.2. gender;
2. What is the respondents’ level of perception on the various constructs of the modified UTAUT as to:
    - 2.1. computer self-efficacy
    - 2.2. system enjoyment
    - 2.3. performance expectancy.
    - 2.4. effort expectancy.
    - 2.5. social influence and
    - 2.6. facilitating condition.
3. Based on the established structural model, what is the degree of significance, of each of the following hypotheses:
    - 3.1. computer self-efficacy affects behavioral Intention.

3.2. computer self-efficacy affects performance.
3.3 system enjoyment affects behavioral intention.
3.4. system enjoyment affects effort expectancy.
3.5. system enjoyment affects performance expectancy.
3.6 performance expectancy affects behavioral intention.
3.7. effort expectancy affects behavioral intention.
3.8. social influence affects behavioral intention.
3.9. facilitating condition affects use behavior and
3.10. behavioral Intention directly affects use behavior.

4. What are the issues and concerns related to using Computer-Aided Drawing (CAD)?

2. Methodology

This research, a mixed-method approach was used to gain a more complete understanding of the problem area. This approach consists of a combination of both quantitative and qualitative research. The quantitative research was explained and predicted concepts that can be generalized to other people and places that objectively measure the variable(s) of interest, which are identified, developed and standardized with attention to validity and reliability. Qualitative research design gives better understanding of people's experiences. Using both as models allows the research filled with information and the researcher to gather for more for her study.

2.1. Respondents

The respondents of the study are grade 9,10 and Grade 11 students with Technical Drafting as their field of specialization on the selected secondary high school of the division of Leyte. The table provides information on the number and percentage of students from each selection schools who participated in the survey.

Table 1. Distribution of Respondents

Name of School	Junior Highschool	Senior Highschool	Total	Percentage
1. Hilongos National Vocational School	56	25	81	**35%**
2. Burauen Comprehensive National Highschool	37		37	**16%**
3. Mahaplag National Highschool		29	29	**12%**
4. Carigara National Vocational School	16		16	**7%**
5. Merida Vocational School	29		29	**12%**
6. Anahawan National High School	41		41	**18%**
TOTAL	179	54	**233**	**100%**

2.2. Data collection and data collection tools

The following procedures were followed to go through the data gathering, a letter of approval from the school principal was secured together with the adapted questionnaire. After the approval of the permission letter, the questionnaires were personally distributed to the respondents. Before filling out the survey questionnaire, an explanation on the purpose of the study is being discussed by the researcher. The research instruments were retrieved personally by the researcher immediately upon the accomplishment of the respondents.

After the retrieval of the questionnaire, the data gathered from the survey questionnaire were tallied, collated, tabled, and subjecting to the following statistical treatment:

Simple Percentage. This was used to determine the percentage of the responses of the respondents.

Weighted Mean. This was utilized to determine the respondent's perception on the various constructs of the modified UTAUT model.

Standard Deviation. This was used to show the variability or dispersion of responses on the various constructs of the modified UTAUT model.

Indicator Loadings, Convergent Validity and Reliability Tests. This was used to assess the quality of the measurement model. Indicator Loadings represent the strength of the relationship between each observed variable and its corresponding latent construct, indicating how well the indicator reflects the latent variable.

Average Variance Extracted. This was used to measure used in the context of confirmatory factor analysis (CFA) and structural equation modeling (SEM) to assess the convergent validity of a latent construct.

Composite Reliability (CR). This was used to measure the internal consistency of each item and verify the consistency of the measurement model. This ensures the reliability and validity of the measurement model.

Cronbach's Alpha. This was used to measure the internal consistency of each item and verify the consistency of the measurement model. This ensures the reliability and validity of the measurement model.

Fornell-Larcker Criterion. This was used to assess the discriminant validity and compares the square root of the Average Variance Extracted (AVE) for each construct to the correlations between that construct and all other constructs in the model.

Heterotrait-Monotrait (HTMT) Ration of Correlation. This was used to determine whether the constructs in the measurement model are sufficiently distinct from one another.

Model Fit and Quality Indices. This was used to evaluate a structural model's ability to accurately reflect the data and assess the robustness of the inter-construct relationships.

Coefficient of Determination (R^2). This was used to indicates the level of variance in the outcome variables accounted for by the predictors.

Full Collinearity Variance Inflation Factor (VIF). This was used to identify multicollinearity risks.

Stone-Geisser's Q^2. This was used to evaluate the cross-validated predictive relevance of a model, it indicates whether the model's predictions of the endogenous constructs are accurate and consistent with the observed data.

Path Coefficient. This was used to determine the direction and intensity of influence that independent variables exert on dependent variables, it gauges direct and indirect effects each of the hypotheses.

3. Findings

The findings of this study are presented under the following:

Table 2. Socio-Demographic Profile of the Respondents

Category	Frequency	Percentage
Age		
12-15	128	65%
16-18	68	35%
Gender		
Male	73	37%
Female	123	63%

Table 2 presents the Socio-Demographic Profile of the Respondents, specifically focusing on two key categories: age and gender. In terms of age, most of the technical drafting students were between 12 to 15 years old, accounting for 128 respondents of the total population, while 68 respondents fell within the 16 to 18 years old age bracket. These figures indicate that most of the respondents belonged to the younger adolescent group, which may reflect the typical age range for junior high school students enrolled in vocational programs. Regarding to gender, the results revealed that 123 respondents were female, while 73 respondents were male. This suggests a higher female participation in drafting technology programs in the selected Secondary Vocational Schools in Leyte Division, offering insights into changing gender trends in technical-vocational education. Overall, the socio-demographic data presented provide a foundational understanding of the respondents' background, which is essential for interpreting their experiences and perceptions of Computer-Aided Drawing (CAD).

Table 3. **Perception on the Computer Self-Efficacy**

Items	Mean	Standard Deviation	Verbal Description
1. I could complete the required tasks using CAD if there was no one around to tell me what to do as I go.	3.24	0.96	Neutral
2. I could complete the required tasks using CAD if I had never used it before.	2.65	1.04	Neutral
3. I could complete the required tasks using CAD if I had only the manuals for reference.	3.66	0.80	Agree
4. I could complete the required tasks using CAD if I could call someone for help if I got stuck.	4.33	0.75	Strongly Agree
5. I could complete the required tasks using CAD if someone else had helped me get started.	4.18	0.79	Agree
6. I could complete the required tasks using CAD if I had a lot of time to complete the task for which was provided.	4.43	0.67	Strongly Agree
7. I could complete the required tasks using CAD if someone showed me how to do it first.	4.47	0.71	Strongly Agree
8. I could complete the required tasks using CAD if I had seen someone else using it before trying it myself.	4.10	0.82	Agree
9. I could complete the required tasks using CAD if I had used similar learning tool like this one before to do the task.	3.94	0.79	Agree

Legend:4.21-5.00=Strongly Agree;
3.41-4.20=Agree;
2.61-3.40=Neutral;
1.81-2.60=Disagree;
1.00-1.80=Strongly Disagree

Table 3 demonstrates the perception on Computer Self-Efficacy. The highest level of agreement was recorded for the item "I could complete the required tasks using CAD if someone showed me how to do it first" followed closely by "if I had a lot of time to complete the task" and "if I could call someone for help if I got stuck")—all receiving a Strongly Agree description. These results suggest that students feel confident in their ability to use CAD, especially when guidance or extended time is available. Moderate agreement was also found for items such as "if someone else had helped me get started", "if I had seen someone else using it before trying it myself", and "if I had used similar learning tool like this one before to do the task". In contrast, lower confidence was shown in scenarios with less support, such as "if I had only the manuals for reference", "if there was no one around to tell me what to do as I go" and "if I had never used it before" the last two falling under the Neutral category. These findings indicate that while students generally exhibit a strong sense of self-efficacy when assistance or familiarization is available, their confidence declines in isolated or unfamiliar scenarios.

Table 4. Perception on the System Enjoyment

Items	Mean	Standard Deviation	Verbal Description
1. The CAD systems make school works more attractive.	4.17	0.74	Agree
2. I find using CAD system to be enjoyable.	4.16	0.76	Agree
3. The information provided by the CAD system meets my exact needs in learning.	4.05	0.76	Agree
4. I find contentment with the accuracy of the CAD system	3.94	0.70	Agree
5. The CAD provides sufficient information.	3.99	0.73	Agree

Table 4 illustrates the perception on System Enjoyment. Students generally agreed that CAD systems contribute positively to their learning experience. The highest mean score was observed for the item "The CAD systems make school works more attractive", indicating that students found CAD visually and functionally engaging. This was closely followed by the statement "I find using CAD system to be enjoyable" Respondents also agreed that "The information provided by the CAD system meets my exact needs in learning" and that they were content with the accuracy of the system. Lastly, students agreed that "The CAD provides sufficient information". These results suggest that the overall experience of using CAD is enjoyable and supportive of students' academic needs.

Table 5. Perception on the Performance Expectancy

Items	Mean	Standard Deviation	Verbal Description
1. I find CAD useful to my study	4.15	0.76	Agree
2. Using CAD enables me to accomplish tasks more quickly.	4.09	0.75	Agree
3. Using CAD increases my productivity	4.02	0.76	Agree
4. Using CAD increase my chances of getting good grade	3.99	0.79	Agree

Table 5 shows the perception on Performance Expectancy. The item with the highest level of agreement was "I find CAD useful to my study" indicating that students clearly see the academic value of CAD.

This was followed by "Using CAD enables me to accomplish tasks more quickly" and "Using CAD increases my productivity", both of which imply that CAD helps streamline school-related tasks. The item "Using CAD increases my chances of getting good grades" also received agreement, reinforcing the belief that CAD use is beneficial to academic performance.

Table 6. Perception on the Effort Expectancy

Items	Mean	Standard Deviation	Verbal Description
1. My interaction with CAD is clear and understandable	3.86	0.70	Agree
2. It is easy for me to become skillful at using CAD	3.68	0.83	Agree
3. I find it easy to use CAD	3.60	0.81	Agree
4. Learning to operate CAD provided by my institution is easy for me	3.78	0.80	Agree

Table 6 depicts the perception on Effort Expectancy. Students found their interaction with CAD clear and understandable suggesting a generally user-friendly system. However, the lower mean for "I find it easy to use CAD" indicates that while the system is comprehensible, it may still pose a learning curve. The items "It is easy for me to become skillful at using CAD" and "Learning to operate CAD provided by my institution is easy for me" were also rated with general agreement. These findings imply moderate ease of use, with room for improvement in training and user support.

Table 7. Perception on the Social Influence

Items	Mean	Standard Deviation	Verbal Description
1. People who influence my behavior think that I should use CAD	3.64	0.75	Agree
2. People who are important to me think that I should use CAD	3.60	0.79	Agree
3. The administration of this school has been supportive in the use of CAD	4.08	0.76	Agree
4. In general, the school, has supported the use of CAD	4.11	0.74	Agree
5. My teacher have been supportive in the use of CAD	4.59	0.59	Strongly Agree

Table 7 outlines the perception on Social Influence. The highest-rated item was "My teachers have been supportive in the use of CAD" receiving a strongly agree description. This was followed by "In general, the school has supported the use of CAD" and "The administration of this school has been supportive in the use of CAD" Students also agreed that important people and influencers in their lives believe they should use CAD Overall, the results suggest strong institutional and social support for CAD integration.

Table 8. Perception on the Facilitating Conditions

Items	Mean	Standard Deviation	Verbal Description

1. I have the resources necessary to use CAD	3.63	0.88	Agree
2. I have the knowledge necessary to use CAD	3.73	0.80	Agree
3. CAD is not compatible with other applications I use (such as MS Word, MS Excel, etc.)	3.36	0.87	Neutral
4. A specific person (or group) is available for assistance with difficulties I experience with CAD	3.97	0.80	Agree
5. Specialized instructions concerning CAD were available to me	3.74	0.80	Agree

Table 8 highlights the perception on Facilitating Conditions. Students agreed that they have the resources necessary to use CAD and have the knowledge necessary to use CAD There was a neutral response regarding the compatibility of CAD with other applications suggesting potential technical barriers. Agreement was higher for items such as availability of assistance and specialized instructions concerning CAD. These results reflect a relatively supportive learning environment, though some compatibility concerns may need to be addressed.

Table 9. **Perception on the Behavioral Intention**

Items	Mean	Standard Deviation	Verbal Description
1. I intend to continue using CAD in the future.	4.06	0.76	Agree
2. I intend to use CAD in doing performance-based activities.	3.96	0.72	Agree
3. I intend to use CAD for coordinating and collaborating with my classmates."	3.91	0.84	Agree
4. I intend to use CAD in my school activities.	3.95	0.79	Agree

Table 9 details the perception on Behavioral Intention. Students expressed strong intent to continue using CAD in the future and in school-related activities. They also agreed that they plan to use CAD in performance-based activities and for collaboration with classmates. These findings indicate that students are positively inclined toward sustained and varied use of CAD in their academic tasks.

Table 10. Perception on the Used Behavior

Items	Mean	Standard Deviation	Verbal Description
1. I use CAD for pedagogy learning.	4.22	0.74	Strongly Agree
2. CAD became part of my learning.	4.38	0.68	Strongly Agree
3. I wish all learning involved CAD.	3.62	0.96	Agree
4. I use CAD when learning in class.	4.05	0.77	Agree
5. I use CAD for accessing personal materials.	3.71	0.85	Agree

6. I consider myself a regular user of CAD.	3.78	0.98	Agree
7. I prefer to use CAD when available.	4.26	0.77	Strongly Agree
8. I do most learning tasks by using CAD.	3.73	0.88	Agree
9. My tendency is towards using CAD whenever possible.	3.97	0.79	Agree

Table 10 outlines the perception on the Used Behavior of the respondents in relation to their engagement with Computer-Aided Drawing (CAD) systems. The highest-rated item was “CAD became part of my learning” with a mean of 4.38 and standard deviation of 0.68, followed by “I prefer to use CAD when available” and “I use CAD for pedagogy learning”, all of which received a verbal description of “Strongly Agree,” suggesting a strong integration of CAD into students’ academic routines. Meanwhile, several items received an “Agree” rating, including “I use CAD when learning in class”, “My tendency is towards using CAD whenever possible” , “I consider myself a regular user of CAD”, “I do most learning tasks by using CAD”, “I use CAD for accessing personal materials”, and “I wish all learning involved CAD” . These results collectively indicate that while a majority of students consistently incorporate CAD into their educational practices, there remains a modest range of variation in their frequency and purpose of use, with overall perception leaning positively toward CAD utilization.

Table 11. Overall Perception of the Constructs in the Model

Constructs	Mean	Standard Deviation	Verbal Description
1. Computer Self-Efficacy	3.89	0.81	Agree
2. System Enjoyment	4.06	0.74	Agree
3. Performance Expectancy	4.06	0.77	Agree
4. Effort Expectancy	3.73	0.78	Agree
5. Social Influence	4.01	0.73	Agree
6. Facilitating Condition	3.69	0.83	Agree
7. Behavioral Intention	3.97	0.78	Agree
8. Use Behavior	3.97	0.86	Agree

Table 11 summarizes the overall perception of the constructs in the model based on the respondents' ratings. The highest-rated constructs were System Enjoyment and Performance Expectancy, both obtaining a mean of 4.06 with standard deviations of 0.74 and 0.77, respectively, indicating that students generally find the CAD system both enjoyable and beneficial to their academic performance. Social Influence also scored notably high, reflecting strong perceived support from peers, teachers, and administrators regarding CAD usage. Meanwhile, Behavioral Intention and Use Behavior both recorded a mean of 3.97, with standard deviations of 0.78 and 0.86, respectively, suggesting that students are likely to continue and sustain the use of CAD in their learning. Computer Self-Efficacy followed closely with a mean of 3.89, showing that students generally feel confident in their ability to use CAD. Effort Expectancy and Facilitating Condition received the lowest ratings among the constructs, implying that while students acknowledge the benefits and show willingness to use CAD, they may still encounter some challenges in terms of ease of use and support infrastructure. Overall, all constructs received a verbal description of “Agree,” suggesting a favorable perception of the CAD system across all key dimensions in the model.

Table 12. **Indicator Loadings, Convergent Validity and Reliability Tests**

Constructs	Items	Factors Loadings	Cronbach's α	CR	AVE
Computer Self-Efficacy	CSE4	(0.735)	0.700	0.834	0.626
	CSE7	(0.846)			
	CSE8	(0.789)			
System Enjoyment	SE2	(0.746)	0.832	0.888	0.666
	SE3	(0.856)			
	SE4	(0.829)			
	SE5	(0.830)			
Performance Expectancy	PE1	(0.775)	0.783	0.860	0.606
	PE2	(0.791)			
	PE3	(0.780)			
	PE4	(0.769)			
Effort Expectancy	EE1	(0.831)	0.857	0.903	0.701
	EE2	(0.880)			
	EE3	(0.847)			
	EE4	(0.788)			
Social Influence	SI1	(0.720)	0.744	0.839	0.566
	SI2	(0.714)			
	SI3	(0.796)			
	SI4	(0.776)			
Facilitating Condition	FC1	(0.854)	0.744	0.855	0.663
	FC2	(0.835)			
	FC5	(0.751)			
Behavioral Intention	BI1	(0.720)	0.830	0.887	0.664
	BI2	(0.851)			
	BI3	(0.818)			
	BI4	(0.863)			
Use Behavior	UB4	(0.814)	0.879	0.887	0.664
	UB5	(0.790)			
	UB6	(0.838)			
	UB8	(0.878)			
	UB9	(0.782)			

Table 12 demonstrates that all constructs met the required thresholds for reliability and convergent validity, confirming the soundness of the measurement model. Computer Self-Efficacy showed acceptable factor loadings, with a Cronbach's alpha of 0.700, Composite Reliability (CR) of 0.834, and Average Variance Extracted (AVE) of 0.626. System Enjoyment had strong loadings, α = 0.832, CR = 0.888, and AVE = 0.666. Performance Expectancy also met the standards, with loadings between 0.769 and 0.791, α = 0.783, CR = 0.860, and AVE = 0.606. Effort Expectancy recorded the highest internal consistency (α = 0.857), with loadings from 0.788 to 0.880, CR = 0.903, and AVE = 0.701. Social Influence presented moderate loadings α = 0.744, CR = 0.839, and AVE = 0.566. Facilitating Condition had loadings from 0.751 to 0.854, α = 0.744, CR = 0.855, and AVE = 0.663. Behavioral Intention achieved α = 0.830, CR = 0.887, AVE = 0.664 with high loadings. Finally, Use Behavior demonstrated strong psychometric properties, with loadings between 0.782 and 0.878, the highest α at 0.879, CR = 0.887, and AVE = 0.664. These results indicate that all constructs are reliable and possess satisfactory convergent validity for subsequent structural modeling.

Table 13. Discriminant Validity using the Forknell-Larcker Criterion

Constructs	1	2	3	4	5	6	7	8
1. Computer Self-Efficacy	(0.791)	0.316	0.260	0.180	0.346	0.194	0.266	-0.063
2. System Enjoyment	0.316	(0.816)	0.680	0.560	0.613	0.463	0.549	0.170
3. Performance Expectancy	0.260	0.680	(0.779)	0.614	0.610	0.486	0.685	0.264
4. Effort Expectancy	0.180	0.560	0.614	(0.837)	0.609	0.679	0.651	0.263
5. Social Influence	0.346	0.613	0.610	0.609	(0.752)	0.650	0.555	0.146
6. Facilitating Condition	0.194	0.463	0.486	0.679	0.650	(0.814)	0.580	0.170
7. Behavioral Intention	0.266	0.549	0.685	0.651	0.555	0.580	(0.815)	0.270
8. Use Behavior	-0.063	0.170	0.264	0.263	0.146	0.170	0.270	(0.821)

Note: Diagonal values are the squareroot of AVE.

Based on Table 13, the discriminant validity of the constructs was confirmed using the Fornell-Larcker criterion, wherein the square root of the Average Variance Extracted (AVE) for each construct (shown on the diagonal in parentheses) is greater than its correlations with other constructs in the model. Specifically, Computer Self-Efficacy ($\sqrt{AVE} = 0.791$), System Enjoyment (0.816), Performance Expectancy (0.779), Effort Expectancy (0.837), Social Influence (0.752), Facilitating Condition (0.814), Behavioral Intention (0.815), and Use Behavior (0.821) each demonstrated higher internal construct correlations compared to their associations with other constructs. This pattern indicates that each construct is empirically distinct and establishes acceptable discriminant validity across the model.

Table 14. Discriminant Validity using HTMT Ratio of correlations

Constructs	1	2	3	4	5	6	7
1. Computer Self-Efficacy							
2. System Enjoyment	0.419						
3. Performance Expectancy	0.355	0.844					
4. Effort Expectancy	0.239	0.669	0.752				
5. Social Influence	0.478	0.780	0.802	0.771			
6. Facilitating Condition	0.282	0.593	0.636	0.848	0.879		
7. Behavioral Intention	0.356	0.670	0.847	0.777	0.714	0.740	
8. Use Behavior	0.091	0.200	0.318	0.304	0.181	0.208	0.314

Note: The HTMT ratios are all significant, that is p <0.05 (one-tailed). The values are within the lower and upper limits of the 90% confidence intervals.

As shown in Table 14, discriminant validity was further assessed using the Heterotrait-Monotrait (HTMT) ratio of correlations, with all HTMT values falling below the recommended threshold of 0.90, indicating adequate discriminant validity among the constructs. Specifically, Computer Self-Efficacy maintained relatively low HTMT correlations with all other constructs (e.g., 0.419 with System Enjoyment, 0.355 with Performance Expectancy). Likewise, inter-construct values such as System Enjoyment and Performance Expectancy (0.844), Effort Expectancy and Facilitating Condition (0.848), and Social Influence and Facilitating Condition (0.879) remained within acceptable bounds. Moreover, all HTMT values were statistically significant at $p < 0.05$ (one-tailed), and within the lower and upper bounds of the 90% confidence intervals, providing robust evidence that the constructs in the model are empirically distinct from one another.

Table 15. Model fit and quality indices

Index Name	Values	Criterion (Kock, 2020)
Average Path Coefficient (APC)	0.201, P<0.001	P <0.05
Average R-Squared (ARS)	0.367, P<0.001	P <0.05
Average Adjusted R-Squared (AARS)	0.358, P<0.001	P<0.05
Average block VIF (AVIF)	1.654	Acceptable if <= 5, ideally <=3.3
Average Collinearity VIF (AFVIF)	2.022	Acceptable if <= 5, ideally <=3.3
Tenenhaus GOF	0.530	Small >=0.1; mediam>=0.25; large >=0.36
Sympson's Paradox Ratio (SPR)	0.846	Acceptable if >=0.7, ideally =1
R-Squared contribution Ratio (RSCR)	0.995	Acceptable if >=0.9, ideally = 1
Statistical Suppression Ratio (SSR)	1.000	Acceptable if >=0.7
Nonlinear Bivariate Causality Direction Ratio	1.000	Acceptable if >=0.7

As presented in Table 15, the model demonstrated a good overall fit and quality based on the criteria established by Kock (2020). The Average Path Coefficient (APC) was 0.201 with a significance level of $p < 0.001$, indicating statistically significant relationships among constructs. The Average R-Squared (ARS) and Average Adjusted R-Squared (AARS) values were 0.367 and 0.358 respectively, both significant at $p < 0.001$, reflecting moderate explanatory power. The Average block VIF (AVIF) and Average Full Collinearity VIF (AFVIF) values were 1.654 and 2.022, both well within the acceptable threshold of 5 and ideal threshold of 3.3, indicating low multicollinearity. The Tenenhaus Goodness-of-Fit (GOF) index was 0.530, which exceeds the threshold for a large effect size (≥0.36), suggesting a strong overall model quality. Furthermore, the Sympson's Paradox Ratio (SPR) of 0.846, R-Squared Contribution Ratio (RSCR) of 0.995, Statistical Suppression Ratio (SSR) of 1.000, and Nonlinear Bivariate Causality Direction Ratio (NLBCDR) of 1.000 all surpassed their respective minimum recommended values, confirming the model's robustness, absence of statistical suppression, and proper causal directionality.

Table 16. Coefficient of Determination, Full Collinearity VIF, Q2

Endogenous Construct	R^2	Full Collinearity VIF	Q^2
1. Performance Expectancy	0.470	2.700	0.472
2. Effort Expectancy	0.317	2.607	0.318
3. Behavioral Intention	0.581	2.421	0.595
4. Use Behavior	0.090	1.148	0.094

Note: R^2 – Coefficient of Determination, Q^2 – Stone-Geisser's Value

Table 16 presents the coefficient of determination (R^2), full collinearity variance inflation factor (VIF), and Stone-Geisser's Q^2 values for the endogenous constructs in the model. The Performance Expectancy construct has an R^2 value of 0.470, indicating that 47% of its variance is explained by the model, with a VIF of 2.700, which is well below the acceptable threshold of 5, indicating no multicollinearity issues. The Q^2 value for Performance Expectancy is 0.472, suggesting medium predictive relevance. For Effort Expectancy, the R^2 is 0.317, meaning 31.7% of its variance is explained by the model, and the Q^2 value is 0.318, demonstrating medium predictive relevance as well. The Behavioral Intention construct exhibits a relatively high R^2 of 0.581, explaining 58.1% of its variance, and a Q^2 value of 0.595, indicating strong predictive relevance. In contrast, the Use Behavior construct shows a much lower R^2 value of 0.090, suggesting that only 9% of its variance is explained by the model, with a Q^2 value of 0.094, indicating very low predictive relevance. The Full Collinearity VIF values for all constructs are well within the acceptable range, ensuring that there are no significant multicollinearity issues affecting the model.

Table 17. Results of Hypothesis Testing

Hypothesis	Path	β	P-value	f^2	Decision
Direct Relationship					
1	CSE→BI	0.080	0.129	0.023	Not Supported
2	CSE→PE	0.074	0.146	0.021	Not Supported
3	SE→BI	0.045	0.261	0.025	Not Supported
4	SE→EE	0.563	<0.001	0.317	Supported
5	SE→PE	0.659	<0.001	0.449	Supported
6	PE→BI	0.396	<0.001	0.272	Supported
7	EE→BI	0.333	<0.001	0.217	Supported
8	SI→BI	0.090		0.052	Not Supported
9	FC→UB	0.021	0.386	0.004	Not Supported
10	BI→UB	0.289	<0.001	0.087	Supported
Moderating Effect					
11	Gender*PE→BI	0.029	0.343	0.010	Not Supported
12	Gender*EE→BI	-0.013	0.425	0.004	Not Supported
13	Gender*SI→BI	0.019	0.397	0.004	Not Supported
Mediating Effect					
14	CSE→PE→BI	0.030	0.277	0.009	Not Supported
15	SE→PE→BI	0.263	<0.001	0.145	Supported
16	SE→EE→BI	0.128	0.005	0.071	Supported

Note: CSE-Computer Self-Efficacy; SE-System Enjoyment; PE-Performance Expectancy; EE-Effort Expectancy; SI-Social Influence; FC-Facilitating Condition; BI-Behavioral Intention; UB-Use Behavior; **$f^2 \geq 0.02$ (Small) - S; $f^2 \geq 0.15$ (Medium) - M; $f^2 \geq 0.35$ (Large) -L**

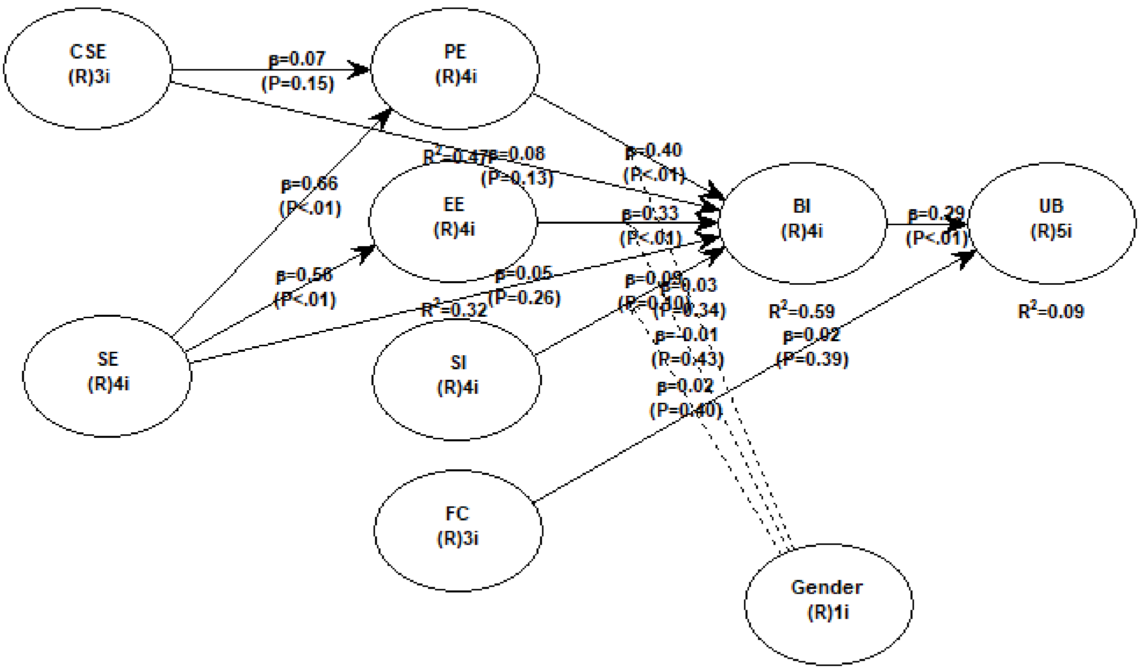

Figure 1. Structural Model with Beta Coefficients

Table 17 provides a comprehensive overview of the hypothesis testing results based on the specified criteria. Hypothesis 1 (CSE → BI) with a path coefficient of 0.080 and p = 0.129, and hypothesis 2 (CSE → PE) with a path coefficient of 0.074 and p = 0.146, were not supported as their p-values were greater than 0.05. Hypothesis 3 (SE → BI), with a path coefficient of 0.045 and p = 0.261, was also not supported. However, hypothesis 4 (SE → EE), with a path coefficient of 0.563 and p < 0.001, was supported with a large effect size (f^2 = 0.317). Hypothesis 5 (SE → PE), with a path coefficient of 0.659 and p < 0.001, was also supported, showing a large effect (f^2 = 0.449). Hypothesis 6 (PE → BI), with a path coefficient of 0.396 and p < 0.001, was supported with a medium effect size (f^2 = 0.272), and hypothesis 7 (EE → BI), with a path coefficient of 0.333 and p < 0.001, was supported with a medium effect size (f^2 = 0.217). Hypothesis 8 (SI → BI), with a path coefficient of 0.090 and p = 0.052, was not supported. Hypothesis 9 (FC → UB), with a path coefficient of 0.021 and p = 0.386, was not supported. Hypothesis 10 (BI → UB), with a path coefficient of 0.289 and p < 0.001, was supported with a small effect size (f^2 = 0.087). In terms of moderating effects, hypotheses 11 (GenderPE → BI), 12 (GenderEE → BI), and 13 (Gender*SI → BI) were all not supported with p-values of 0.343, 0.425, and 0.397, respectively. For mediating effects, hypothesis 14 (CSE → PE → BI) was not supported (p = 0.277), while hypothesis 15 (SE → PE → BI) was supported (p < 0.001, f^2 = 0.145) and hypothesis 16 (SE → EE → BI) was supported (p = 0.005, f^2 = 0.071). These findings highlight the significant roles of system enjoyment and effort expectancy in influencing behavioral intentions and use behavior, while other relationships and moderating effects were not statistically significant.

Table 18. Issues and Concerns in Using Computer-Aided Drawing (CAD)

Issues and Concerns	Mean	Standard Deviation	Verbal Description

1. Accuracy in using CAD.	3.60	0.93	Very Satisfactory
2. Speed in using CAD.	3.41	0.97	Very Satisfactory
3. Neatness in using CAD.	3.68	0.98	Very Satisfactory
4. Legibility in using CAD.	3.62	0.92	Very Satisfactory
5. Comfortability in using CAD.	3.88	0.92	Very Satisfactory
6. Decrease in error percentage.	3.18	1.00	Satisfactory
7. Decrease design effort.	3.18	1.03	Satisfactory
8. Higher Productivity level.	3.78	0.96	Very Satisfactory
9. Keys are working on keyboard.	4.13	0.93	Very Satisfactory
10. Keyboard keys are not faded.	3.94	1.01	Very Satisfactory
11. Mouse is functioning well.	4.17	0.94	Very Satisfactory
12. Commands run faster or does not hang after executed.	3.72	1.00	Very Satisfactory
13. Drawing files are faster to open.	3.70	0.98	Very Satisfactory
14. The computer is functioning smoothly and responsively.	3.75	1.00	Very Satisfactory

Legend:4.21-5.00= Outstanding (O);
3.41-4.20=Agree Very Satisfactory (VS;
2.61-3.40= Satisfactory;
1.81-2.60=Fair;
1.00-1.80=Strongly Disagree

As shown in Table 18, students reported a very satisfactory level of accuracy in using CAD, with a mean score of 3.60 Similarly, speed in using CAD was rated very satisfactory at 3.41 Neatness and legibility, crucial aspects in technical drawings, were also rated very satisfactory, scoring 3.68 and 3.62 respectively. Comfortability in using CAD received the highest among the skill-related items, with a mean of 3.88, indicating strong user confidence. On the other hand, decrease in error percentage and decrease in design effort both garnered mean scores of 3.18, falling under the satisfactory category. These indicate that while CAD tools are perceived to aid in accuracy and efficiency, students still encounter moderate challenges in minimizing errors and reducing effort in design.

4. Discussions

In the level of perception on Computer Self-Efficacy. The highest level of agreement was recorded for the item "I could complete the required tasks using CAD if someone showed me how to do it first" , followed closely by "if I had a lot of time to complete the task", and "if I could call someone for help if I got stuck" ,-all receiving a Strongly Agree description. These results suggest that students feel confident in their ability to use CAD, especially when guidance or extended time is available. Moderate agreement was also found for items such as "if someone else had helped me get started", "if I had seen someone else using it before trying it myself", and "if I had used similar learning tool like this one before to do the task". In contrast, lower confidence was shown in scenarios with less support, such as "if I had only the manuals for reference", "if there was no one around to tell me what to do as I go", and "if I had never used it before"-the last two falling under the Neutral category. These findings indicate that while students generally exhibit a strong sense of self-efficacy when assistance or familiarization is available, their confidence declines in isolated or unfamiliar scenarios.

In the level of perception on System Enjoyment. Students generally agreed that CAD systems contribute positively to their learning experience. The highest mean score was observed for the item "The CAD systems make school works more attractive", indicating that students found CAD visually and functionally engaging. This was closely followed by the statement "I find using CAD system to be enjoyable". Respondents also agreed that "The information provided by the CAD system meets my exact needs in learning" and that they

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were content with the accuracy of the system. Lastly, students agreed that "The CAD provides sufficient information". These results suggest that the overall experience of using CAD is enjoyable and supportive of students' academic needs.

On the perception on Performance Expectancy. The item with the highest level of agreement was "I find CAD useful to my study" indicating that students clearly see the academic value of CAD. This was followed by "Using CAD enables me to accomplish tasks more quickly" and "Using CAD increases my productivity" both of which imply that CAD helps streamline school-related tasks. The item "Using CAD increases my chances of getting good grades" also received agreement reinforcing the belief that CAD use is beneficial to academic performance.

The perception on Effort Expectancy, students found their interaction with CAD clear and understandable suggesting a generally user-friendly system. However, the lower mean for "I find it easy to use CAD" indicates that while the system is comprehensible, it may still pose a learning curve. The items "It is easy for me to become skillful at using CAD" and "Learning to operate CAD provided by my institution is easy for me" were also rated with general agreement. These findings imply moderate ease of use, with room for improvement in training and user support.

On the perception on Social Influence. The highest-rated item was "My teachers have been supportive in the use of CAD" receiving a strongly agree description. This was followed by "In general, the school has supported the use of CAD" and "The administration of this school has been supportive in the use of CAD". Students also agreed that important people and influencers in their lives believe they should use CAD. Overall, the results suggest strong institutional and social support for CAD integration.

On Facilitating Conditions. Students agreed that they have the resources necessary to use CAD and have the knowledge necessary to use CAD. There was a neutral response regarding the compatibility of CAD with other applications suggesting potential technical barriers. Agreement was higher for items such as availability of assistance and specialized instructions concerning CAD. These results reflect a relatively supportive learning environment, though some compatibility concerns may need to be addressed.

The perception on Behavioral Intention, students expressed strong intent to continue using CAD in the future and in school-related activities. They also agreed that they plan to use CAD in performance-based activities and for collaboration with classmates. These findings indicate that students are positively inclined toward sustained and varied use of CAD in their academic tasks.

Moreover, on the perception on the Used Behavior of the respondents in relation to their engagement with Computer-Aided Drawing (CAD) systems. The highest-rated item was “CAD became part of my learning” with a mean of 4.38 and standard deviation of 0.68, followed by “I prefer to use CAD when available” and “I use CAD for pedagogy learning” all of which received a verbal description of “Strongly Agree,” suggesting a strong integration of CAD into students’ academic routines. Meanwhile, several items received an “Agree” rating, including “I use CAD when learning in class, “My tendency is towards using CAD whenever possible”, “I consider myself a regular user of CAD” ,“I do most learning tasks by using CAD”, “I use CAD for accessing personal materials” and “I wish all learning involved CAD”. These results collectively indicate that while a majority of students consistently incorporate CAD into their educational practices, there remains a modest range of variation in their frequency and purpose of use, with overall perception leaning positively toward CAD utilization.

The overall perception of the constructs in the model based on the respondents' ratings. The highest-rated constructs were System Enjoyment and Performance Expectancy, indicating that students generally find the CAD system both enjoyable and beneficial to their academic performance. Social Influence also scored notably high reflecting strong perceived support from peers, teachers, and administrators regarding CAD usage. Meanwhile, Behavioral Intention and Use Behavior both recorded a mean of 3.97, with standard deviations of 0.78 and 0.86, respectively, suggesting that students are likely to continue and sustain the use of CAD in their learning. Computer Self-Efficacy followed closely with a mean of 3.89 showing that students generally feel confident in their ability to use CAD. Effort Expectancy and Facilitating Condition received the lowest ratings among the constructs, implying that while students acknowledge the benefits and show willingness to use CAD, they may still encounter some challenges in terms of ease of use and support infrastructure. Overall, all constructs received a verbal description of "Agree," suggesting a favorable perception of the CAD system across all key dimensions in the model.

On the results from Structural Equation Modeling (SEM), focusing on the analysis performed using WarpPLS 8.0, a powerful tool designed for complex multivariate analysis, particularly within Partial Least Squares (PLS) path modeling. The results of the first phase highlight key indicators such as factor loadings, composite reliability, and average variance extracted (AVE) (Ali et al., 2023). Afterward, the structural model analysis is presented, emphasizing path coefficients, the significance of relationships, and the overall explanatory power of the model (Leclercq-Machado et al., 2022). The analyses provide a comprehensive understanding of the influence of factors such as computer self-efficacy, system enjoyment, performance expectancy, effort expectancy, social influence, facilitating conditions, and behavioral intention on the use behavior of drafting technology students in the context of Computer-Aided Drawing (CAD) implementation.

Measurement Model Analysis Results shows an in-depth review of the robustness of the measurement model, focusing on crucial metrics such as Indicator Loadings, Convergent Validity, and Reliability Tests. Indicator loadings are evaluated to ensure that each observed variable adequately represents its corresponding latent construct. Convergent validity is assessed through the Average Variance Extracted (AVE) for each construct and reliability tests, including Composite Reliability (CR) and Cronbach's Alpha, are conducted to confirm the consistency of the constructs. The tests establish the measurement model as a solid and trustworthy foundation for analyzing structural relationships. To further validate the measurement model, Discriminant Validity is tested using two methods: the Fornell-Larcker Criterion and the HTMT Ratio. These tests offer a comprehensive examination of whether the constructs are truly distinct, which is critical for the integrity of the subsequent structural model analysis.

In the Structural Model Analysis findings assesses the model's fit, quality, and hypothesis validation. Key model fit indicators like RMSEA and standardized path coefficients confirm that the model accurately represents theoretical relationships. RMSEA evaluates the discrepancy between observed and predicted data, while path coefficients reveal the strength and significance of inter-variable links. The analysis further reviews the Coefficient of Determination (R^2), Variance Inflation Factor (VIF), and cross-validated redundancy index (Q^2). R^2 gauges explanatory power, VIF detects multicollinearity, and Q^2 assesses predictive relevance. The section concludes with hypothesis testing outcomes, examining each proposed relationship's strength, direction, and significance to validate the model's theoretical foundation and empirical integrity.

In the structural model's that evaluates the statistical robustness using a comprehensive set of fit and quality metrics. The model demonstrated strong statistical significance and explanatory power, with an Average Path Coefficient (APC) of 0.201 ($p < 0.001$), and Average R-Squared (ARS) and Adjusted R-Squared (AARS) values of 0.367 and 0.358, respectively, both significant at $p < 0.001$. Collinearity diagnostics revealed low multicollinearity, with AVIF (1.654) and AFVIF (2.022) well within acceptable limits. The Tenenhaus Goodness-of-Fit (GOF) index was 0.530, indicating a large effect size and strong model adequacy. Additional indices—SPR (0.846), RSCR (0.995), SSR (1.000), and NLBCDR (1.000)—all exceeded minimum thresholds, affirming the model's predictive consistency, explanatory validity, absence of suppression effects, and correct causal directionality. Collectively, these results confirm the model's overall fit, reliability, and theoretical soundness.

The result of hypothesize testing in the structural model through path coefficients (β), p-values, and effect sizes (f^2) to determine the strength, direction, and significance of each construct's influence. Path coefficients show the magnitude and direction of relationships, while p-values assess statistical significance (threshold: $p < 0.05$), and effect sizes (f^2) reflect the practical importance of each relationship—categorized as small (≥0.02), medium (≥0.15), and large (≥0.35). The analysis revealed that hypotheses involving System Enjoyment (SE) significantly influenced Effort Expectancy (EE) and Performance Expectancy (PE), with strong effects ($\beta = 0.563$ and 0.659; both $p < 0.001$) and large effect sizes ($f^2 = 0.317$ and 0.449, respectively). PE and EE were also significant predictors of Behavioral Intention (BI), with medium effect sizes. Behavioral Intention significantly influenced Use Behavior (UB) ($\beta = 0.289$, $p < 0.001$, $f^2 = 0.087$), however, constructs like Computer Self-Efficacy (CSE) and Social Influence (SI) did not significantly predict BI, nor did Facilitating Conditions (FC) influence UB. Moderating effects of Gender on the relationships were also not significant. Among the mediation paths, only the indirect effects of SE → PE → BI and SE → EE → BI were supported, suggesting System Enjoyment plays a critical mediating role in shaping user behavior through perceived performance and effort. Overall, the findings emphasize the importance of system enjoyment and user expectations in shaping technology adoption behavior, while highlighting the limited role of demographic and environmental moderators in this model.

On the issues and concerns in using Computer-Aided Drawing (CAD), this section explores the challenges encountered by drafting technology students in their use of Computer-Aided Drawing (CAD), aiming to improve instructional approaches and system support. The data show that the students generally had a very satisfactory experience with Computer-Aided Drawing in terms of usability, system responsiveness, and productivity. However, minor concerns remain in optimizing error reduction and design effort, which are areas that could benefit from additional training or system improvements.

5. Conclusions

All constructs received a verbal description of "Agree," reflecting a consistently positive perception of CAD integration across all measured dimensions. These insights underscore the importance of maintaining enjoyable and supportive learning environments while also addressing usability and system support issues to optimize the effectiveness of CAD in technical-vocational education programs.

In conclusion, this study affirms that CAD is a highly beneficial and engaging tool for drafting technology students. To further enhance its effectiveness, educators and institutions should focus on strengthening support structures and minimizing usage challenges. These insights can inform policy formulation, curriculum development, and the future integration of digital tools in vocational education.

6. Recommendations

Based on the findings of this study, several targeted recommendations can be proposed to enhance the effectiveness, accessibility, and sustained use of Computer-Aided Drawing (CAD) systems among drafting technology students in secondary vocational schools:

1. Enhance Technical Training and Support Programs. According to Venkatesh et al. (2012), who found that improved training mitigates perceived difficulty and enhances technology acceptance. Hair et al. (2021), also emphasizes the need for capacity building when introducing new technologies in learning environments. Given that Effort Expectancy and Facilitating Conditions received the lowest ratings, therefore schools should implement structured training programs and workshops focused on improving students' CAD skills, particularly for beginners. Providing hands-on tutorials, peer mentoring, and access to video guides can ease the learning curve.

2. Strengthen Infrastructure and Resource Accessibility. Davis (1989), who emphasized that perceived ease of use and system compatibility are critical to user adoption of technology. Improving hardware performance, software availability, and ensuring technical support personnel are available will strengthen the Facilitating Conditions for CAD usage. Ensuring compatibility between CAD and other school systems or learning platforms is also essential.

3. Integrate CAD into Core Curriculum. Bandura (1997), who asserts that frequent exposure and reinforcement improve self-efficacy and actual behavior. To solidify Behavioral Intention and Use Behavior, CAD use should be fully embedded into the curriculum across various drafting and design subjects. This includes using CAD for all major projects and encouraging collaborative CAD-based activities.

4.Sustain System Enjoyment Through Engaging Applications. According to Venkatesh et al. (2003), who found that enjoyment significantly enhances motivation and behavioral intention in technology use. To maintain high levels of System Enjoyment, educators should incorporate gamified learning elements, real-world CAD projects, and creative design challenges that allow students to explore the practical and fun sides of CAD systems.

5.Foster Ongoing Institutional and Peer Support. Yulin and Danso (2025), who emphasize the necessity of focused training initiatives and supportive institutional policies to enhance educators' readiness for digital innovation. Given the positive influence of Social Influence, continued advocacy and support from teachers and administrators are vital. Schools should encourage collaborative CAD usage, create student tech clubs, and celebrate CAD achievements to strengthen the learning community.

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Appendix A

SURVEY QUESTIONNAIRES

In order to help me with the analysis, the first few questions are for classification purposes.

Name: ___________________________________ Age: _____ Gender: _______

Address: ____

Dear Respondents:

I would welcome your views on assessing the impact of computer-aided drawing on student learning. Please be honest in your views and base your answers on your personal experience using CAD. You may or may not indicate your name on the respondents' profile for confidentiality of your identity.

In accordance with the RA 10173 or the Data Privacy Act of 2012, all personal and/ or sensitive information solicited and disclosed from this questionnaire shall only be used for the study alone. Rest assured that your responses in this instrument will be kept confidential. Thank you for taking time to complete this questionnaire.

Sincerely ,
EMMA N. LUZON
Researcher

Direction: Please rate the impact of computer-aided drawing on student learning and achievement using the parametric scale presented below by checking the appropriate box that corresponds your rating.

Weight	Scale	Category	Verbal Description
5	4.21-5.00	Strongly Agree (SA)	When the impact is great
4	3.41- 4.21	Agree (A)	When the impact is good
3	2.61-3.40	Neutral (N)	When the impact is average
2	1.81-2.60	Disagree (D)	When the impact is poor
1	1.00-1-81	Strongly Disagree (SD	When the impact is very poor

Part I. Level of perception on the various constructs of the Structural Equation Modeling using Computer-Aided Drawing (CAD)

Descriptive Statistics for Computer Self-Efficacy	**5 (SA)**	**4 (A)**	**3 (N)**	**2 (D)**	**1 (SD)**
1. I could complete the required tasks using CAD if there was no one around to tell me what to do as I go.					
2. I could complete the required tasks using CAD if I had never used it before.					
3. I could complete the required tasks using CAD if I had only the manuals for reference.					
4. I could complete the required tasks using CAD if I could call someone for help if I got stuck.					
5. I could complete the required tasks using CAD if someone else had helped me get started.					
6. I could complete the required tasks using CAD if I had a lot of time to complete the task for which was provided.					
7. I could complete the required tasks using CAD if someone showed me how to do it first.					
8. I could complete the required tasks using CAD if I had seen someone else using it before trying it myself.					
9. I could complete the required tasks using CAD if I had used similar learning tool like this one before to do the task.					
Descriptive Statistics for System Enjoyment					
1. The CAD systems make school works more attractive.					
2. I find using CAD system to be enjoyable.					
3. The information provided by the CAD system meets my exact needs in learning.					
4. I find contentment with the accuracy of the CAD system					
5. The CAD provides sufficient information.					
Descriptive Statistics for Performance Expectancy					
1. I find CAD useful to my study					
2. Using CAD enables me to accomplish tasks more quickly.					
3. Using CAD increases my productivity					
4. Using CAD increase my chances of getting good grade					
Descriptive Statistics for Effort Expectancy					
1. My interaction with CAD is clear and understandable					
2. It is easy for me to become skillful at using CAD					
3. I find it easy to use CAD					
4. Learning to operate CAD provided by my institution is easy for me					
Descriptive Statistics for Social Influence					
1. People who influence my behavior think that I should use CAD					
2. People who are important to me think that I should use CAD					
3. The administration of this school has been supportive in the use of CAD					
4. In general, the school, has supported the use of CAD					

5. My teacher have been supportive in the use of CAD					
Descriptive Statistics for Facilitating Conditions					
1. I have the resources necessary to use CAD					
2. I have the knowledge necessary to use CAD					
3. CAD is not compatible with other applications I use (such as MS Word, MS Excel, etc.)					
4. A specific person (or group) is available for assistance with difficulties I experience with CAD					
5. Specialized instructions concerning CAD were available to me					
Descriptive Statistics for Behavioral Intention					
1. I intend to continue using CAD in the future.					
2. I intend to use CAD in doing performance-based activities.					
3. I intend to use CAD for coordinating and collaborating with my classmates.”					
4. I intend to use CAD in my school activities.					
Descriptive Statistics for Used Behavior					
1. I use CAD for pedagogy learning.					
2. CAD became part of my learning.					
3. I wish all learning involved CAD.					
4. I use CAD when learning in class.					
5. I use CAD for accessing personal materials.					
6. I consider myself a regular user of CAD.					
7. I prefer to use CAD when available.					
8. I do most learning tasks by using CAD.					
9. My tendency is towards using CAD whenever possible.					

Part II. Issues and concerns related to using of Computer- Aided Drawing (CAD).

Weight	Scale	Category	Verbal Description
5	4.21-5.00	Outstanding (O)	When the effectiveness is fully attained.
4	3.41- 4.21	Very Satisfactory (VS	When the effectiveness is partially attained.
3	2.61-3.40	Satisfactory (S)	When the effectiveness is attained
2	1.81-2.60	Fair (F)	When the effectiveness is partially not attained.
1	1.00-1-81	Poor (P)	When the effectiveness is not attained.

Issues and Concerns	**5 (O)**	**4 (VS)**	**3 (S)**	**2 (F)**	**1 (P)**
1. Accuracy in using CAD					
2. Speed in using CAD.					

3. Neatness in using CAD.					
4. Legibility in using CAD					
5. Comfortability in using CAD.					
6. Decrease in error percentage.					
7. Decrease design effort.					
8. Higher Productivity level					
9. Keys are working on keyboard.					
10. Keyboard keys are not faded.					
11. Mouse is functioning well.					
12. Commands run faster or does not hang after executed.					
13. Drawing files are faster to open.					
14. The computer is functioning smoothly and responsively.					

Thank you for your help in compiling this variable information.

Appendix B

Informed Consent Form for <u>Assessing the Impact of Computer-Aided Drawing on Student Learning in Vocational Education: A PLS-SEM Approach of the UTAUT Model</u>

Name of Researcher: Emma N. Luzon
Institution: Department of Education- Schools Division of Leyte
Contact Information: emmluzon@gmail.com, 09156925074

PART I: INFORMATION SHEET

INTRODUCTION

You are invited to participate in a research study conducted by Emma N. Luzon from Hilongos National Vocational School, because you fit the inclusion criteria for informants of our study.

Your participation is completely voluntary. Please read the information below, and ask questions about anything you do not understand, before deciding whether to participate. Please take as much time as you need to read the consent form.

If you decide to participate, you will be asked to sign this form. You will be given a copy of this form.

PURPOSE OF THE RESEARCH

This study aims to assess the impact of computer-aided drawing (CAD) on student learning in vocational education among technical drafting students of Leyte Division. It also seeks to analyze factors influencing

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students' acceptance and use of CAD using the Unified Theory of Acceptance and Use of Technology (UTAUT) model through PLS-SEM analysis.

TYPE OF RESEARCH INTERVENTION

The study employs a quantitative, non-experimental, correlational research design. It examines the educational technology intervention involving the use of computer-aided drawing (CAD) in technical drafting classes. The study does not manipulate variables but analyzes relationships among UTAUT constructs and student learning outcomes using Partial Least Squares Structural Equation Modeling (PLS-SEM).

PARTICIPANT SELECTION

The respondents are technical drafting students in the Leyte Division with prior experience in using computer-aided drawing (CAD).

VOLUNTARY PARTICIPATION

Participation in this study is entirely voluntary. You are free to decide whether or not to take part in the research without any pressure or obligation. Participants may choose not to answer any question that makes them uncomfortable. Their decision to participate or not will not affect their grades, academic standing, or relationship with their teachers, school, or the researcher.

PROCEDURES

If you volunteer to participate in this study, you will be asked to answer a structured questionnaire about your experiences, perceptions, and use of computer-aided drawing.

DURATION

The questionnaire will take approximately 15–20 minutes to complete. Participants are requested to answer the survey during a scheduled time approved by the school. They may stop at any point if they wish to withdraw.

RISKS

You may feel discomfort when answering questions, but you may skip any question you do not wish to answer. You may opt not to answer questions which make you feel any psychological or emotional distress, or you can withdraw as a participant of the study if you feel that you cannot discuss the information that is asked of you. The researcher values your participation and will place your welfare as their highest priority during the study.

BENEFITS

This study can generate relevant information which can be useful to public and private administrators, human resource managers, and policymakers. The results, discussions, and findings from this study can spark evidence-based information which can be used by different educational agencies as basis for improvement on the curricular framework, teaching methodologies, styles and strategies.

REIMBURSEMENTS

You will not receive any monetary compensation for taking part in this study. There are also no costs involved in participating. The activity will be conducted during a scheduled school period, and no personal expenses are expected.

CONFIDENTIALITY

We will keep your records for this study confidential as far as permitted by law. Any identifiable information obtained in connection with this study will remain confidential, except if necessary to protect your rights or welfare. This certificate means that the researcher can resist the release of information about your participation to people who are not connected with the study. When the results of the research are published or discussed at conferences, no identifiable information will be used.

SHARING THE RESULTS

The results of this study will be reported in summary form only, and no individual participant will be identified. Personal information will always remain confidential.

RIGHT TO REFUSE OR WITHDRAW

Your participation is voluntary. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study.

WHO TO CONTACT

If you have any questions or concerns about the research, please feel free to contact the researcher through mobile phone number 09156925074 or through email at emmluzon@gmail.com; or if you need to see her, she can be located at Hilongos National Vocational School, Hilongos, Leyte.

PART II: CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Print Name of Participant: ___________________________

Signature of Participant: ____________________________

Date: ___________________

[MM/DD/YYYY]

To be accomplished by the Researcher Obtaining Consent:

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Print Name of Researcher or person taking the consent: ____________________

Signature of Researcher or person taking the consent: ______________________

Date: ____________________

[MM/DD/YYYY]