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METEOR STIP MARUNDA

pISSN : 1979 – 4746
eISSN : 2685 - 4775

Maritime Institute of Jakarta

Analysis of the Utilization of Computer-Based Training (CBT) Simulators in Supporting the Teaching and Learning Activities of Lecturers and Students

(Maritime Education and Training Institutions Under the Ministry of Transportation)

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Submitted : 20/01/2026 ***Revised*** : 07/02/2026 ***Accepted*** : 27/05/2026 ***Published*** : 30/06/2026

ABSTRACT

The Ministry of Transportation operates twelve maritime education and training institutions (Lemdiklat) at the college and polytechnic level, providing maritime education and training to the public. To increase the effectiveness of teaching and learning activities for lecturers and learners, these institutions employ the Seagull Computer-Based Training (CBT) simulator software in accordance with the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, as amended in 1995. However, the utilization of the CBT simulator continues to encounter numerous obstacles, such that its implementation remains suboptimal. This study analyzes the effect of CBT simulator utilization on the teaching and learning activities of lecturers and learners, focusing on two maritime training institutions: the Jakarta College of Shipping (STIP) and the Semarang Polytechnic of Shipping Science (PIP). A descriptive quantitative method was used, with data collected via questionnaires distributed to 88 lecturer and learner respondents. Descriptive analysis shows that CBT simulator utilization variables contribute positively to the teaching and learning process, accounting for 84.9% of the variance. The classical assumption tests indicate that the data are normally distributed (Asymp. Sig. = 0.200) and free of heteroscedasticity. The t-test shows that CBT simulator utilization has a significant effect ($p < 0.000$) on learning outcomes, and the coefficient of determination (R^2) confirms an 84.9% contribution to teaching and learning activities. These findings provide a strong basis for encouraging the integration of technology into the maritime education and training curriculum. Further research is recommended to explore additional variables that may affect learning outcomes.

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Keywords: *learning media; teaching and learning activities; curriculum; maritime education and training*

1. INTRODUCTION

Computers constitute a medium capable of providing near-immediate feedback on learning outcomes to learners, while also being able to store and manipulate information as needed. The rapid development of technology has enabled computers to load and display an increasingly wide range of media formats. Computer technology is today no longer confined to computation and word processing; it also serves as a multimedia learning tool that allows students to design and engineer concepts and scientific content.

Computer-based multimedia presentation may be defined as a technology that optimizes the computer's role in displaying and integrating text, graphics, and sound within a single presentation. Through a display capable of combining multiple elements of information and message delivery, the computer can be designed and deployed as an effective technological medium for teaching and learning relevant course material.

Computer-based multimedia can likewise be used to conduct simulations that train specific skills and competencies — for example, a ship-handling simulator that allows maritime students to practice collision-avoidance navigation, or a cargo-control-room simulator that allows students to practice loading and discharging operations.

The development of computer technology has also created networks enabling students to discuss and interact with a broad range of learning resources. Computer networks in the form of the internet and the web have opened access for anyone to obtain the latest information and knowledge within a given academic field. This development has likewise brought considerable change to application software, in an ongoing effort to enable technology to model real-world conditions more closely, with the underlying emphasis remaining on maximizing teaching and learning activity as a cognitive interaction between learners, subject matter, and lecturers. A computer system can deliver instruction directly to learners by having them interact with content programmed into the system — this is the essence of computer-assisted instruction.

The learning process is an interaction possessing normative value, while teaching and learning activity is a conscious and purposeful process. The objective set for a given teaching and learning activity serves as the guiding reference for the direction that activity will take, and the process is judged successful when its outcomes produce genuine change in students' knowledge, understanding, skills, and values. In organizing learning so that students can meet its objectives, lecturers must plan carefully, and one of the most important planning decisions concerns the choice of learning model.

A learning model may be defined as a plan grounded in psychological theory that guides lecturers in planning and implementing teaching and learning activities; alternatively, it may be understood as a conceptual framework comprising a systematic set of procedures, developed from theory and used to organize the teaching and learning process toward its objectives [1]. Selecting a learning model therefore means that the lecturer determines the underlying pattern of classroom learning activity — encompassing both the material to be presented and the methods to be used. Although the curriculum's learning objectives are set by the Ministry of Transportation's Transportation Human Resources Development Agency (BPSDM) through its defined syllabus and competency standards, the specific learning material presented remains within the lecturer's discretion. While that material must relate closely to the stated objectives, lecturers may also introduce content not directly tied to those objectives — for instance, material addressing current or emerging developments. With respect to learning method, BPSDM Transportation's guidance is limited to specifying a learner-centered approach, intended to make students more active participants in the teaching and learning process, leaving open a wide range of specific methods lecturers may employ to this end.

The minimum competency standards for seafarers are set out in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978. In addition to the provisions of STCW 1978, the specific pedagogical requirements for deck and engine seafarer training are further specified through the Model Course guidebooks issued by the International Maritime Organization (IMO). These IMO Model Courses enable stakeholders to develop training programmes that keep learners' knowledge and skills current with the needs of maritime technology.

Computer-assisted learning activity, more commonly known as Computer-Based Training (CBT), is the general term for any learning activity that employs computers, whether in part or in whole. Computer-based learning is a relatively recent concept that has already produced numerous designs and implementations within education and training, arising as a concrete manifestation of the globalization of information and communication technology in the delivery of instruction.

One computer-based learning model applied in the delivery of instruction is the CBT simulator. A CBT simulator is a tool or system used to deliver education and training through computers, allowing users to learn interactively through simulations, exercises, and evaluations run on computers or other electronic devices. It may incorporate a range of learning methods, including multimedia tutorials, process or activity simulations, and quizzes or tests designed to strengthen the user's understanding and skill within a particular subject area. Simulation-type learning is a strategy intended to provide a more concrete learning experience through an imitation that closely resembles the real-world situation; a simulation-type CBT may accordingly be understood as computer-mediated learning that uses the computer as a learning medium employing this same close-to-real-world imitation strategy.

At present, teaching and learning activity for several subjects at maritime training institutions under the Ministry of Transportation has already been supported by CBT simulator-based learning. However,

the availability of the CBT simulator remains suboptimal, and several obstacles have been identified in its utilization. Learners have not been sufficiently motivated to develop their knowledge and skills constructively in order to learn actively and construct the concepts being taught. Lecturers and learners still tend to rely more heavily on informative textbooks. Lecturers have not received dedicated training in using the CBT simulator as an adopted computer-based learning model, and BPSDM Sea Transportation, as the body responsible for syllabus design, has not yet fully integrated CBT simulator content with the curriculum and subject-level learning objectives. Maritime training institutions, as the parties responsible for instructional delivery, have not made sustained efforts to update simulator content or maintain the simulator system so that it remains relevant and effective under current conditions.

Based on the foregoing, the authors were motivated to conduct research titled "Analysis of Computer-Based Training (CBT) Simulator Utilization in Supporting Teaching and Learning Activities of Lecturers and Learners at Maritime Education and Training Institutions Under the Ministry of Transportation."

2. METHOD

2.1 Method Used

This research is a field study involving direct observation of the object under investigation in order to obtain relevant data. The method applied is quantitative analysis, using in-depth numerical data analysis [2].

2.2 Conceptual and Operational Definition of Variables

A conceptual definition is the boundary of understanding that a researcher assigns to a variable or concept to be measured, investigated, and for which data are to be extracted [3]. Variable operationalization is the process of decomposing a research variable into sub-variables, dimensions, sub-variable indicators, and measurements. As stated by Sugiyono, "A variable is an attribute, trait, or value belonging to a person, object, or activity that displays a certain variation, set by the researcher for study and for drawing conclusions" [4].

Consistent with the study's title, two variables are identified: Variable X (CBT Simulator Utilization) and Variable Y (Supporting Teaching and Learning Activities of Lecturers and Learners). These two variables may be further distinguished as follows.

1. **Independent variable.** As defined by Sugiyono, an independent variable is "a variable that affects or causes a change in, or the emergence of, the dependent (bound) variable" [4]. In this study, the independent variable is CBT Simulator Utilization (X).
2. **Dependent variable.** As defined by Sugiyono, a dependent variable is "the variable that is influenced by, or that results from, the independent variable" [4]. In this study, the dependent variable is Supporting Teaching and Learning Activities of Lecturers and Learners (Y).

2.3 Data Collection Technique

The data source for this study is primary data — data obtained by the researcher directly from its first source, whether an individual or individuals, such as the results of interviews or completed questionnaires [5]. Data collection in this study relied on primary sources, meaning sources that provide data directly to the data collector [5]. The data collection techniques used were questionnaires and interviews; the questionnaire was administered directly to lecturer and learner respondents, and the period allotted for data collection and supporting literature review was a maximum of one month.

The questionnaire was compiled through the following steps:

1. Literature review.
2. Determination of question indicators and dimensions.
3. Finalization by the research team of these indicators and dimensions into both closed- and open-ended questionnaire items.

2.4 Sampling Technique

The population for this study comprised:

1. Lecturers and students of STIP Jakarta.
2. Lecturers and students of Politeknik Ilmu Pelayaran (PIP) Semarang.

Purposive sampling was used, with the following composition:

1. STIP Jakarta sample: 25 lecturer respondents and 25 student respondents actively participating in the current semester's learning activities.
2. PIP Semarang sample: 13 lecturer respondents and 25 learner respondents actively participating in the current semester's learning activities.

Table 2.1. Questionnaire Grid

Variable	Dimension	Indicator	Statement	+	−
CBT Simulator Utilization (X)	1. Availability	1. Availability of varied material in the CBT Simulator.	1. Materials in the CBT Simulator vary to match competency levels.	✓	
		2. Availability of learning resources that can be updated to reflect current conditions.	2. CBT Simulator learning resources can be updated in line with the latest developments.	✓	✓

		3. A positive and inclusive learning atmosphere within the CBT Simulator.	3. The CBT Simulator does not create a positive and inclusive learning atmosphere.		
	2. Ability	1. Lecturers understand and have experience using the CBT Simulator. 2. The CBT Simulator has good speed and responsiveness.	4. Lecturers are accustomed to using the CBT Simulator in teaching and learning activities. 5. Learners have good ability in using the CBT Simulator. 6. The CBT Simulator has never experienced technical issues.	✓ ✓	✓
	3. Ease	1. Ease of access in understanding and using the CBT Simulator. 2. The CBT Simulator provides easy feedback on usage performance and immediate assistance.	7. The CBT Simulator can be used easily without obstacles. 8. Features in the CBT Simulator are easily understood by learners. 9. Lecturers find it easier to provide material and tasks through the CBT Simulator. 10. The CBT Simulator is difficult to use as a learning medium in teaching and learning activities.	✓ ✓ ✓	✓
Supporting Teaching and Learning Activities for Lecturers and Learners (Y)	1. Relevance	1. Relevance of CBT Simulator learning materials to graduates' competency needs. 2. Comparison of CBT Simulator utilization with the traditional learning model, which tends to rely on informative textbooks.	1. Material in the CBT Simulator is relevant to the competency needs of graduates. 2. Simulated situations in the CBT Simulator are relevant and resemble the real situation. 3. Relevance of learning materials in the CBT Simulator can be maintained because it is easily and quickly updated. 4. Use of the CBT Simulator is relevant to reducing costs associated with physical training that carries a risk of error or harm. 5. Use of the CBT Simulator is not relevant to helping understand the concept being taught.	✓ ✓ ✓ ✓	✓
	2. Usability	1. Intensity of lecturers' and students' use of the CBT Simulator for teaching and learning activities. 2. Usefulness of the CBT Simulator for improving graduate competency.	6. Lecturers utilize the CBT Simulator to provide material and tasks. 7. The CBT Simulator helps learners understand the concept of the material being taught. 8. Learners submit assignments using the CBT Simulator. 9. Interaction and activeness of lecturers and learners in the learning process using the CBT Simulator. 10. Use of the CBT Simulator does not motivate learners or improve learning outcomes.	✓ ✓ ✓ ✓	✓

Table 2.2. Statement Items for the CBT Simulator Utilization Aspect (Variable X)

No.	Statement	SS	S	R	TS	STS
1	The material in the CBT Simulator has variety corresponding to the competency level.					
2	Learning resources in the CBT Simulator can be updated according to the latest developments.					
3	The CBT Simulator does not create a positive and inclusive learning atmosphere.					

4	Lecturers are accustomed to using the CBT Simulator in teaching and learning activities.
5	Learners have good ability in using the CBT Simulator.
6	The CBT Simulator has never experienced any technical issues.
7	The CBT Simulator can be used easily without any problems.
8	The features in the CBT Simulator are easily understood by learners.
9	Lecturers find it easier to provide materials and assignments through the CBT Simulator.
10	The CBT Simulator is difficult to use as a learning medium in teaching and learning activities.

Table 2.3. Statement Items for Aspects of Supporting Teaching and Learning Activities of Lecturers and Cadet Learners (Variable Y)

No.	Statement	SS	S	R	TS	STS
1	Relevant CBT Simulator learning materials meet the competency needs of graduates.					
2	The simulated situation in the CBT Simulator is relevant and resembles the real thing.					
3	The relevance of learning materials in the CBT Simulator can be maintained in line with developments because it is easily and quickly updated.					
4	The use of the CBT Simulator is relevant to reducing the cost of physical training, which poses a risk of errors or danger.					
5	The use of the CBT Simulator is not relevant to helping understand the concept being taught.					
6	Lecturers utilize the CBT Simulator to provide materials and assignments.					
7	The CBT Simulator helps learners understand the concept of the material being taught.					
8	Learners submit assignments using the CBT Simulator.					
9	Interaction and activeness of lecturers and learners in the learning process using the CBT Simulator.					
10	The use of the CBT Simulator does not motivate or improve learning outcomes.					

3. Analysis and Discussion

3.1 Analysis

1. Descriptive Statistical Test

The descriptive statistical test characterizes the variables under study — CBT Simulator Utilization (X) and Supporting Teaching and Learning Activities of Lecturers and Learners (Y) — across the two maritime training institutions, STIP Jakarta and PIP Semarang. Data were obtained from a questionnaire comprising ten statement items completed by 88 respondents, processed using SPSS version 25.

a. CBT Simulator Utilization Variable

Descriptive analysis showed a mean CBT simulator utilization score of 39.82, reflecting respondents' generally positive perception of the simulator's effectiveness and quality in supporting learning. The median of 40.00 indicates that half of the respondents scored above this level, suggesting a strong consensus regarding the effectiveness of CBT simulator use [6]. The mode of 50.00 indicates a subgroup of respondents who are highly satisfied with the features and benefits offered, while the standard deviation of 7.370 reflects meaningful variation in utilization experience across respondents.

Table 3.1. Frequency Distribution of CBT Simulator Utilization Variables

No.	Interval	f	Percentage
1	28–30	9	10.23%
2	31–33	6	6.82%
3	34–36	13	14.77%
4	37–39	15	17.05%
5	40–42	18	20.45%
6	43–45	4	4.55%
7	46–48	4	4.55%
8	49–51	19	21.59%
	Total	88	100%

Source: Primary data processed, 2024.

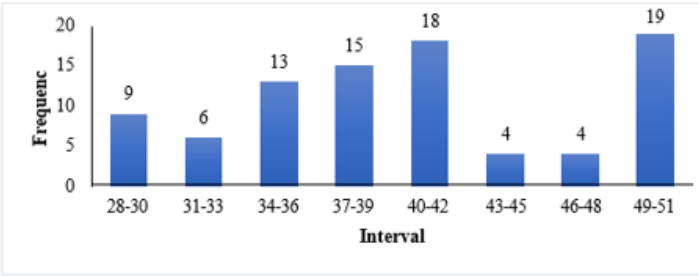


Figure 3.1 Frequency Distribution Bar Diagram of CBT Simulator Utilization Variables

Figure 3.1: Frequency distribution bar chart of CBT Simulator utilization variables, plotting the eight intervals in Table 3.1 against their respective frequencies.

The bar chart shows that 21.59% of respondents fall within the 49–51 interval, indicating that the majority of respondents perceive maximum benefit from the CBT simulator, while only 4.55% fall within the lowest category (43–45), suggesting that although most respondents report a positive impact, a small subset may not be fully utilizing the available features. The CBT simulator utilization variable was further categorized using an ideal mean (Mi) of 30 and an ideal standard deviation of 6.67, yielding the three classes shown in Table 3.2.

Table 3.2. Score Categorization Requirements

No.	Category	Terms	Frequency	Percentage
1	Good	> 36.67	60	68.18%
2	Fair	23.33–36.67	28	31.82%
3	Poor	< 23.33	0	0%
	Total		88	100%

Table 3.2 indicates that 68.18% of respondents fall within the "Good" category, showing that the CBT simulator meets user expectations, while 31.82% fall within the "Fair" category, indicating a need for improvement such as additional user training [6], [7]. The study also identifies several strategic recommendations for improving CBT simulator utilization, including the development of training modules with more realistic practice and training scenarios, structured support for users to gain a deeper understanding of the simulator's features and functions, and improved access to more interactive learning resources such as video tutorials and online discussion forums to support self-directed learning.

b. Variable Supporting Teaching and Learning Activities of Lecturers and Learners (Y)

Analysis of this variable showed a mean of 40.55, with a median and mode both at 40.00, indicating a positive assessment of teaching and learning activities involving the CBT simulator. The standard deviation of 7.270 indicates that, while most respondents held similar perceptions, some variation in experience existed between lecturers and learners [8].

Table 3.3. Frequency Distribution of Variables Supporting Teaching and Learning Activities of Lecturers and Learners

No.	Interval	f	Percentage
1	28–30	8	9.09%
2	31–33	3	3.41%
3	34–36	13	14.77%
4	37–39	17	19.32%
5	40–42	18	20.45%
6	43–45	3	*(percentage not separately stated in source)*
7	46–48	6	*(percentage not separately stated in source)*
8	49–51	20	22.73%
	Total	88	100%

Source: Primary data processed, 2024.

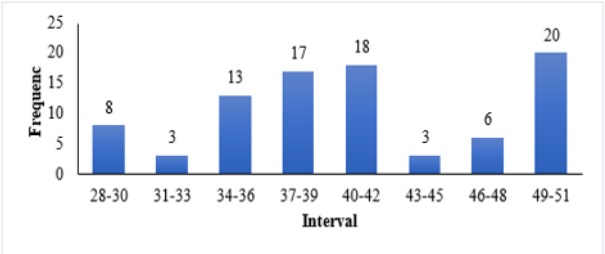


Figure 3.2: Bar chart of the frequency distribution of variables

Figure 3.2: Bar chart of the frequency distribution of variables supporting teaching and learning activities of lecturers and students, plotting the eight intervals in Table 3.3 against their respective frequencies.

The majority of respondents (22.73%) fall within the 49–51 interval, confirming that the CBT simulator effectively supports teaching and learning activities and that users experience increased engagement and improved learning outcomes [9]. Categorization of this variable, again using an ideal mean (Mi) of 30 and an ideal standard deviation (SDi) of 6.67, yields the classes shown in Table 3.4.

Table 3.4. Score Categorization Requirements

No.	Category	Terms	Frequency	Percentage
1	Good	> 36.67	64	72.73%
2	Fair	23.33–36.67	24	27.27%
3	Poor	< 23.33	0	0%
	Total		88	100%

A total of 72.73% of respondents rate the support these activities receive as "Good," indicating that CBT simulator use contributes not only a technological benefit but also increased interaction and active participation in learning. The remaining 27.27% of respondents fall within the "Fair" category, indicating room for improvement. Establishing a regular feedback system to evaluate user experience is therefore important, enabling adjustments to the training module — particularly with respect to factors such as insufficient features or difficulty of use — that influence these perceptions [10].

2. Data Quality Test

The data quality test ensures that the instrument used for data collection can measure the variables under study accurately and consistently, a property that depends heavily on the instrument's validity and reliability. This test was applied to the questionnaires completed by the 88 respondents evaluating the two main variables — CBT Simulator Utilization (X) and Supporting Teaching and Learning Activities of Lecturers and Learners (Y) — across the two institutions.

a. Validity Test

The validity test is a critical step in confirming that a research instrument accurately measures its intended variables. In this study, the validity test was conducted using a twenty-item questionnaire distributed to the 88 respondents. As shown in Table 3.5, all items produced a correlation coefficient (r-count) greater than the r-table value of 0.2096.

Table 3.5. Validity Test Results

Variable	Item	Correlation Coefficient	r-table	Description
CBT Simulator Utilization (Variable X)	Question 1	0.739	0.2096	Valid
	Question 2	0.748	0.2096	Valid
	Question 3	0.642	0.2096	Valid
	Question 4	0.768	0.2096	Valid
	Question 5	0.794	0.2096	Valid
	Question 6	0.747	0.2096	Valid
	Question 7	0.764	0.2096	Valid
	Question 8	0.808	0.2096	Valid
	Question 9	0.814	0.2096	Valid
	Question 10	0.646	0.2096	Valid
Supporting Teaching and Learning Activities for Lecturers and Participant Students (Variable Y)	Question 1	0.781	0.2096	Valid
	Question 2	0.805	0.2096	Valid
	Question 3	0.831	0.2096	Valid
	Question 4	0.812	0.2096	Valid
	Question 5	0.629	0.2096	Valid
	Question 6	0.838	0.2096	Valid
	Question 7	0.764	0.2096	Valid
	Question 8	0.777	0.2096	Valid
	Question 9	0.849	0.2096	Valid
	Question 10	0.629	0.2096	Valid

Table 3.5 shows that every item in the questionnaire, for both the CBT Simulator Utilization variable (X) and the Supporting Teaching and Learning Activities variable (Y), meets the criteria for validity. The correlation coefficients range from 0.629 to 0.849, indicating that each item significantly captures the construct under measurement, consistent with the principle of construct validity, which holds that an instrument must adequately represent the dimensions of the variable it is designed to measure [11].

The Pearson product-moment correlation coefficient method is well suited to this context, given the interval nature of the data and the assumption of normality typically expected in social research. Prior studies have similarly emphasized the importance of validity testing for strengthening the reliability of research findings in educational and technological contexts [6], [12]. The consistency of results across items indicates that the research instrument was well designed and appropriate to the context under study; this high level of validity also provides a strong foundation for further analysis and supports the conclusion that the resulting measurements can be interpreted with confidence. All question items were accordingly retained for subsequent analysis, providing assurance that the resulting data are representative of actual conditions.

b. Reliability Test

Reliability testing is a critical step in assessing the consistency and stability of the measurement

instrument used. High reliability indicates that the instrument produces consistent results under repeated measurement, lending confidence to the data obtained.

Table 3.6. Reliability Test Results

Variable	Cronbach's Alpha	Total Questions	Description
CBT Simulator Utilization (Variable X)	0.884	10 items	Reliable
Supporting Teaching and Learning Activities for Lecturers and Learners (Variable Y)	0.892	10 items	Reliable

Table 3.6 shows that both variables achieve very good Cronbach's Alpha values — 0.884 and 0.892, respectively — far exceeding the generally accepted threshold of 0.60, confirming that the instrument used in this study is reliable. A Cronbach's Alpha value above 0.80 indicates a very high level of reliability, consistent with the standards expected in social and educational research [12], [11]. This reliability strengthens confidence in both the validity of the data collected and the overall research findings.

3. Classical Assumption Test

The classical assumption test ensures that the data used meet the conditions required for valid statistical testing. This study examines normality, linearity, and the absence of heteroscedasticity; satisfying these assumptions is a precondition for proceeding with further analysis.

a. Normality Test

The normality test was conducted using the One-Sample Kolmogorov–Smirnov test, considered more appropriate than graphical analysis alone, particularly for larger samples. Data are considered normally distributed if the significance value (Asymp. Sig., 2-tailed) exceeds 0.05.

Table 3.7. One-Sample Kolmogorov–Smirnov Test Results

		Unstandardized Residuals
N		88
Normal Parameters	Mean	0.0000000
	Std. Deviation	0.22819097
Most Extreme Differences	Absolute	0.173
	Positive	0.173
	Negative	−0.053
Test Statistic		0.173
Asymp. Sig. (2-tailed)		0.200

Test distribution is Normal. Calculated from data. Lilliefors Significance Correction. This is a lower bound of the true significance. Source: SPSS version 25 output.

The Asymp. Sig. (2-tailed) value of 0.200 exceeds 0.05, indicating that the variable residuals are normally distributed. Satisfying the normality assumption is a prerequisite for more complex regression analysis, which requires normally distributed residuals to produce efficient and unbiased estimates [12], [11].

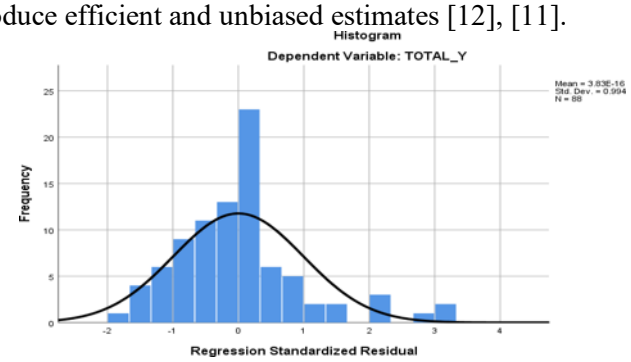


Figure 3.3: Data normality test results (histogram)

Figure 3.3: Data normality test results (histogram), showing a symmetrical bell-shaped distribution centered on the mean with no visible skewness to the left or right, indicating a normal distribution and reliable, unbiased resulting parameters. (Source: primary data processing results, 2024.)

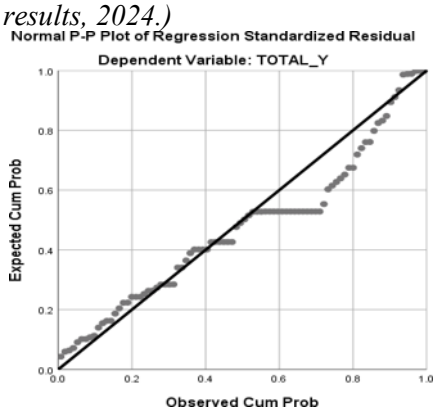


Figure 3.4: Normal probability

Figure 3.4: Normal probability (P-P) plot of the regression standardized residual, showing data points distributed closely along the diagonal reference line, indicating a distribution close to normal and reinforcing the Kolmogorov–Smirnov result.

Together, the Kolmogorov–Smirnov test result and the histogram and normal probability plot visualizations support the conclusion that the study's data are normally distributed, permitting the subsequent classical-assumption tests to proceed.

b. Linearity Test

The linearity test identifies the form of the relationship between the independent variable (CBT simulator utilization) and the dependent variable

(supporting teaching and learning activities of lecturers and learners), an important step in regression analysis since the linearity assumption must be satisfied for the resulting model to yield accurate and reliable predictions. The test evaluates the significance of the deviation from linearity; a value greater than 0.05 indicates a linear relationship between the two variables.

Table 3.8. Linearity Test Results (ANOVA Table)

		Sum of Squares	df	Mean Square	F	Sig.
TOTAL_Y * TOTAL_X	Between Groups (Combined)	4127.473	21	196.546	27.580	0.000
	Linearity	3901.744	1	3901.744	547.503	0.000
	Deviation from Linearity	225.730	20	11.286	1.584	0.084
	Within Groups	470.345	66	7.126		
	Total	4597.818	87			

Source: SPSS version 25 output.

The deviation-from-linearity significance value of 0.084 exceeds 0.05, indicating a significant linear relationship between CBT simulator utilization and teaching and learning activities, confirming that simulator use can exert a genuine, positive effect in an educational context.

c. Heteroscedasticity Test

The heteroscedasticity test evaluates whether the variance of residuals differs across observations in the regression model; the presence of heteroscedasticity can bias parameter estimates and reduce the validity of research findings. A model with constant residual variance is termed homoscedastic, while one with differing variance is termed heteroscedastic. This test was conducted both by examining the scatterplot pattern and by applying the Glejser test for greater precision, under the condition that a significance value greater than 0.05 indicates the absence of heteroscedasticity.

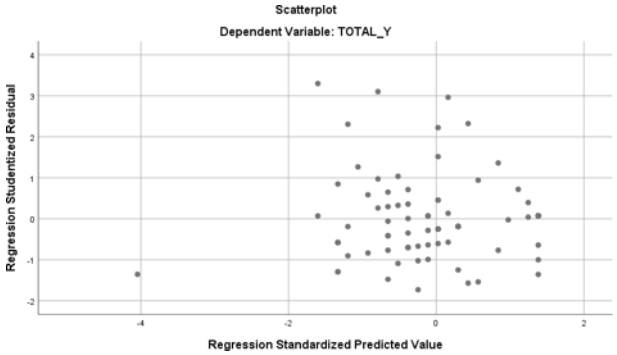


Figure 3.5: Heteroscedasticity test scatterplot

Figure 3.5: Heteroscedasticity test scatterplot (regression studentized residual against regression standardized predicted value), showing points distributed without a discernible pattern above and below zero on the Y-axis. (Source: primary data processing results, 2024.)

The scatterplot output shows no discernible pattern, with points scattered above and below zero on the Y-axis, indicating an absence of heteroscedasticity — that is, a homoscedastic model.

Table 3.9. Glejser Test Results

Model		Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
1	(Constant)	5.559	1.129		4.921	0.000
	TOTAL_X	−0.090	0.028	−0.329	−3.231	0.060

Source: SPSS version 25 output.

The significance value for the CBT simulator utilization variable (Variable X) is 0.060, exceeding 0.05, indicating an absence of heteroscedasticity in the tested model and confirming the analysis as valid and reliable. Together, the linearity and heteroscedasticity test results indicate that the model satisfies the basic assumptions of regression analysis; the presence of a linear relationship combined with homoscedasticity indicates that CBT simulator utilization can effectively support teaching and learning activities, contributing meaningfully to the development of more effective learning methods in the digital era.

4. Hypothesis Test

a. Simple Linear Regression Analysis

Linear regression analysis was applied to evaluate the effect of CBT simulator utilization (independent variable, X) on the teaching and learning activities of lecturers and learners (dependent variable, Y) across the two maritime training institutions. This method identifies the strength and direction of the relationship between the two variables while allowing the influence of other, unmeasured variables to be accounted for.

Table 3.10. Linear Regression Test Results

Model		Unstandardized	Std.	Standardized	t	Sig.

		Coefficients (B)	Error	Coefficients (Beta)		
1	(Constant)	4.362	1.676		2.603	0.011
	TOTAL_X	0.909	0.041	0.921	21.956	0.000

Source: SPSS version 25 output.

From Table 3.10, the regression equation is: **Y = 4.362 + 0.909X + e**.

Interpretation of the regression equation:

1. The constant (intercept) of 4.362 indicates that, in the absence of CBT simulator utilization (X = 0), teaching and learning activities (Y) are estimated at 4.362, reflecting a baseline contribution not accounted for by other variables in the model.
2. The regression coefficient for variable X of 0.909 indicates that each one-unit increase in CBT simulator utilization is associated with a 0.909 increase in teaching and learning activities, demonstrating a significant positive relationship in which increased CBT simulator utilization contributes substantially to the effectiveness of the teaching and learning process.

The significance value (p-value) for the TOTAL_X variable is 0.000, well below the 0.05 threshold, indicating a highly significant effect of CBT simulator utilization on teaching and learning activities and supporting acceptance of the study's hypothesis of a positive effect.

b. Correlation Coefficient Analysis

Pearson correlation coefficient analysis was used to measure and evaluate the direction and strength of the relationship between CBT Simulator Utilization (X) and Supporting Teaching and Learning Activities of Lecturers and Learners (Y), providing insight relevant to decision-making in curriculum development and learning strategy.

Table 3.11. Pearson Correlation Coefficient Test Results

		TOTAL_X	TOTAL_Y
TOTAL_X	Pearson Correlation	1	0.921**
	Sig. (2-tailed)		0.000
	N	88	88
TOTAL_Y	Pearson Correlation	0.921**	1
	Sig. (2-tailed)	0.000	
	N	88	88

***Correlation is significant at the 0.01 level (2-tailed). Source: SPSS version 25 output.*

Table 3.11 shows a Pearson correlation coefficient of 0.921, indicating a very strong, positive relationship between CBT simulator utilization (X) and teaching and learning activities (Y); a coefficient this close to 1 indicates that as CBT simulator utilization increases, teaching and learning activity increases correspondingly. The associated significance value (p = 0.000), well below the α = 0.01 threshold, confirms that this relationship is not only strong but also statistically significant, consistent with prior findings in the educational literature indicating that the integration of technology into learning can improve student learning outcomes [13], [14]. This finding carries a practical implication: by recognizing the strength of this relationship, managers of educational institutions can be encouraged to further promote CBT simulator use within the curriculum, thereby fostering a more interactive and effective learning environment.

c. t-Test

The partial t-test assesses the extent to which CBT Simulator Utilization (X) contributes independently to Supporting Teaching and Learning Activities of Lecturers and Learners (Y).

Table 3.12. Partial Test (t-Test) Results

Model		Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
1	(Constant)	4.362	1.676		2.603	0.011
	TOTAL_X	0.909	0.041	0.921	21.956	0.000

Source: SPSS version 25 output.

The CBT simulator utilization variable (X) shows a significance value of 0.000, well below α = 0.05, indicating a highly significant effect of X on Y. The calculated t-value for variable X is 21.956, compared with a t-table value of 1.988 at 85 degrees of freedom (α/2; n − k − 1 = 0.025; 85). Since t-count (21.956) exceeds t-table (1.988), H0 is rejected, confirming that CBT simulator utilization (X) has a partially significant effect in supporting the teaching and learning activities of lecturers and students (Y), and that increased CBT simulator utilization has a positive impact on the effectiveness of the learning process.

d. R^2 Test (Coefficient of Determination)

The coefficient of determination (R^2) measures the extent to which the independent variable (X) explains variation in the dependent variable (Y); R^2 ranges from 0 to 1, with values closer to 1 indicating a stronger explanatory contribution of the independent variable.

Table 3.13. R^2 Test Results (Coefficient of Determination)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.921[a]	0.849	0.847	2.845

a. Predictors: (Constant), TOTAL_X. Dependent Variable: TOTAL_Y. Source: SPSS version 25 output.

Table 3.13 shows an R^2 value of 0.849, indicating that approximately 84.9% of the variation in teaching and learning activities of lecturers and learners (Y) is explained by CBT simulator utilization (X) — confirming a significant contribution of CBT simulator utilization to the effectiveness of the teaching and learning process. The remaining 15.1% is attributable to factors outside this study, which could include teaching method, student motivation, and the quality of teaching resources, all of which may influence learning outcomes.

These findings carry significant implications for decision-making at the level of educational policy. Given the high contribution of CBT simulator utilization, managers of educational institutions are advised to encourage deeper integration of technology into the curriculum; educational technology of this kind not only enriches the learning experience but also has the potential to improve learner outcomes in today's digital era [15], [16].

3.2 Discussion

1. Multiple linear regression analysis conducted at STIP Jakarta and PIP Semarang shows a significance value (p-value) for the TOTAL_X variable of 0.000, well below the 0.05 threshold, indicating a highly significant effect of CBT simulator utilization on teaching and learning activities and supporting acceptance of the study's hypothesis of a positive effect.
2. The Pearson correlation coefficient analysis yields a coefficient of 0.921, indicating a very strong, positive relationship between CBT simulator utilization (X) and teaching and learning activities (Y); a coefficient this close to 1 indicates that as CBT simulator utilization increases, teaching and learning activity increases correspondingly. The associated significance value ($p = 0.000$), well below $\alpha = 0.01$, confirms that this relationship is not only strong but also statistically significant, with educational technology such as the CBT simulator playing an important role in improving learning effectiveness.
3. The coefficient of determination analysis shows that approximately 84.9% of variation in teaching and learning activities of lecturers and learners (Y) is explained by CBT simulator utilization (X), confirming a significant contribution of CBT simulator utilization to the effectiveness of the teaching and learning process. The remaining 15.1% is attributable to factors outside this study, which could include teaching method, student motivation, and the quality of teaching resources, all of which may influence learning outcomes.

4. CONCLUSION

Based on the analysis conducted, this study demonstrates that CBT simulator utilization at the Ministry of Transportation's maritime education and training institutions — specifically STIP Jakarta and PIP Semarang — is significantly effective in supporting teaching and learning activities. The descriptive statistical test shows that CBT simulator utilization contributes 84.9% to the learning process, with a regression coefficient indicating that every one-unit increase in simulator utilization increases learning outcomes by 0.909. The normality test (Asymp. Sig. = 0.200) and heteroscedasticity test (significance > 0.05) confirm that the data satisfy the classical assumptions, while the t-test confirms a significant effect of CBT simulator utilization ($p < 0.000$), affirming that this technology plays an important role in improving teaching quality.

5. RECOMMENDATIONS

1. Lemdiklat administrators are advised to integrate the CBT simulator more deeply into curriculum development, using relevant and engaging materials.
2. Intensive training for lecturers is needed to optimize CBT simulator use in the teaching process.
3. A regular monitoring and evaluation system should be implemented to assess the effectiveness of CBT simulator use.
4. Further research is needed to explore additional variables that may affect learning outcomes, so that understanding of teaching dynamics becomes more comprehensive.

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