

# UTILIZATION OF LABORATORIES AND EDUCATIONAL SERVICES AND THEIR INFLUENCE ON STUDENTS' MATERIAL MASTERY

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## ABSTRACT

Rapid developments in science and technology demand that schools optimize learning facilities and educational services to improve students' mastery of learning materials. In many junior high schools, especially in developing and border areas, laboratories and educational services are available but not always utilized optimally. This study aims to analyze the influence of laboratory utilization (computer and science laboratories) and educational services on students' material mastery in junior high schools across Raimanuk District, Belu Regency. Employing a quantitative *ex post facto* research design, data were collected through questionnaires administered to 100 teachers selected using proportional random sampling from a population of 133 teachers in six junior high schools. The data were analyzed using multiple regression analysis to examine both partial and simultaneous effects of the independent variables on students' material mastery. The results indicate that laboratory utilization has a positive and significant effect on students' mastery of learning materials. Educational services also show a significant positive influence, and jointly both variables contribute meaningfully to explaining variations in students' material mastery. These findings suggest that practical learning experiences supported by structured and responsive educational services enhance students' conceptual understanding. In conclusion, this study highlights that improving learning outcomes requires not only the availability of laboratories but also their effective utilization and integration with quality educational services. The study contributes scientifically by reinforcing an integrative perspective on educational infrastructure and services as complementary determinants of learning quality.

**Keywords:** Educational Services, Junior High School, Laboratory Utilization, Learning Outcomes, Material Mastery

## INTRODUCTION

The rapid development of science and technology has changed the expectations placed on schools. Education systems are required to prepare learners who are able to understand concepts, use information critically, and adapt to technological and social change. Schools therefore need to provide not only classroom instruction but also learning facilities and academic services that enable students to engage actively with learning materials. In this context, school facilities and infrastructure are not merely physical assets; they are instructional resources that support the quality of learning processes and outcomes (Camelia, 2020; Khotimah et al., 2021).

Laboratories are among the most important facilities in junior high school learning. Computer laboratories provide access to digital learning resources, information-processing activities, simulations, and technology-based learning tasks. When computer laboratories are used appropriately, students can explore learning content beyond textbook explanations and develop digital familiarity that supports contemporary learning demands (Hilmiati, 2021; Sandi & Karim, 2024). Science laboratories also play a crucial role in supporting inquiry, experimentation, observation, and practical work in science learning. Through laboratory-based activities, students are expected to connect abstract concepts with concrete experiences, thereby improving their comprehension and retention of subject matter (Reza et al., 2023).

From a theoretical perspective, the influence of laboratory utilization on students' subject-matter mastery can be understood through experiential learning and constructivist learning. Kolb's experiential learning theory explains that learning occurs through a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). Laboratory activities allow students to participate in this cycle because they observe phenomena, manipulate objects or data, reflect on results, and connect findings to conceptual explanations. Similarly, social constructivist theory emphasizes that learning is strengthened through guidance, scaffolding, and interaction with teachers and peers (Vygotsky, 1978). Thus, laboratories become educationally meaningful when teachers facilitate students' inquiry rather than treating the laboratory as a separate or purely procedural activity.

Educational services are also central to the quality of learning. In this study, educational services refer to the school's organized support for students' learning needs, including academic guidance, teacher responsiveness, access to learning resources, learning support outside classroom hours, and the coordination of instructional services. Educational service quality is important because students' mastery of learning materials is influenced not only by the availability of facilities but also by the extent to which schools provide guidance, feedback, continuity, and support for learning (Lovelock, 2002; Tjiptono, 2008; Wiyono, 2020).

Raimanuk District is located in Belu Regency, East Nusa Tenggara Province, and borders Malaka Regency. The district has six junior high schools: Raimanuk Public Junior High School, Satu Atap Obor Public Junior High School, Mandala Public Junior High School, Lorotuan Public Junior High School, Noebiti Public Junior High School, and Satap Knabu Public Junior High School. These schools were established gradually between 2007 and 2022 as part of the government's commitment to improving access to junior secondary education. Because several schools are relatively new, their facilities, teacher readiness, and service systems have developed unevenly.

Preliminary interviews with principals and teachers indicated that, during the early years of school establishment, instruction relied heavily on lectures because learning facilities were limited. Some science teachers attempted to conduct simple practical activities using basic equipment and outdoor environments. In recent years, government support has improved facilities in several schools, including computer laboratories, science laboratories, libraries, and other learning resources. Nevertheless, the existence of these facilities does not automatically ensure their optimal instructional use. The effective utilization of laboratories depends on scheduling, teacher competence, equipment readiness, school management, and the integration of laboratory work with learning objectives.

Previous studies have examined laboratory utilization and learning outcomes from different perspectives. Studies on computer laboratory utilization have often focused on independent learning in information and communication technology or specific technical subjects (Asri, 2020; Hilmiati, 2021). Other studies have examined science laboratory use, laboratory management, or the contribution of facilities to learning outcomes (Badaruddin & Ibrahim, 2022; Reza et al., 2023; Sandi & Karim, 2024). However, many of these studies focused on one laboratory type, one subject, or one school. Although previous studies have examined the effect of computer laboratory utilization, science laboratory use, and learning facilities on student outcomes, most have focused on single subjects, single schools, or isolated laboratory types. Limited studies have examined the combined influence of computer and science laboratory utilization together with educational services on students' subject-matter mastery across several junior high schools in developing and border-region contexts.

Based on this gap, the present study analyzes the influence of laboratory utilization and educational services on students' subject-matter mastery in junior high schools across Raimanuk District, Belu Regency. The novelty of this study lies in its integrative perspective: it does not examine laboratories as stand-alone facilities but positions laboratory utilization and educational services as complementary determinants of learning quality. The study is expected to provide empirical and practical insights for school leaders, teachers, and policymakers seeking to improve learning effectiveness in resource-developing educational contexts.

## **METHOD**

This study used a quantitative *ex post facto* research design. The design was appropriate because the study examined the influence of existing independent variables, namely laboratory utilization and educational services, on students' subject-matter mastery without manipulating the research subjects or providing experimental treatment. The study was conducted in six junior high schools in Raimanuk District, Belu Regency, East Nusa Tenggara Province.

The population consisted of all teachers in the six junior high schools, totaling 133 teachers. The distribution of the population was as follows: 24 teachers at Raimanuk Public Junior High School, 16 teachers at Satu Atap Obor Public Junior High School, 30 teachers at Mandala Public Junior High School, 26 teachers at Lorotuan Public Junior High School, 20 teachers at Noebiti Public Junior High School, and 17 teachers at Satap Knabu Public Junior High School. The respondents were teachers because they were considered to have direct knowledge of laboratory utilization, educational services, and students' learning

mastery in their schools. Therefore, students' subject-matter mastery in this study refers to teachers' questionnaire-based assessment of students' mastery, not students' direct test scores.

The sample size was determined using the Slovin formula with a 5% margin of error:  $n = N / (1 + Ne^2)$ , where  $n$  is the sample size,  $N$  is the population size, and  $e$  is the error tolerance. Based on  $N = 133$  and  $e = 0.05$ , the minimum sample size was approximately 100 teachers. The sampling technique was proportional random sampling to ensure that each school was represented according to its proportion in the population.

Table 1. Population and Proportional Sample Distribution

No.	School	Population (N)	Proportional Sample (n)
1	Raimanuk Public Junior High School	24	18
2	Satu Atap Obor Public Junior High School	16	12
3	Mandala Public Junior High School	30	23
4	Lorotuan Public Junior High School	26	20
5	Noebiti Public Junior High School	20	15
6	Satap Knabu Public Junior High School	17	12
Total	Total	133	100

Data were collected using a structured questionnaire with a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire consisted of three variable blocks: laboratory utilization (X1), educational services (X2), and students' subject-matter mastery (Y). Laboratory utilization was measured through indicators of facility availability, frequency of use, instructional integration, equipment readiness, teacher guidance, and student engagement in laboratory-based activities. Educational services were measured through academic guidance, access to learning resources, teacher responsiveness, learning assistance, feedback, and service coordination. Students' subject-matter mastery was measured through teachers' assessment of students' conceptual understanding, ability to apply concepts, ability to analyze learning tasks, retention of material, and linkage of learning content to real-life contexts.

Table 2. Operational Definitions and Instrument Indicators

Variable	Operational Definition	Main Indicators	Items	Scale
Laboratory utilization (X1)	The extent to which computer and science laboratories are used effectively to support teaching and learning.	Availability, access, frequency of use, instructional integration, equipment readiness, teacher guidance, practical learning activities.	12	Likert 1-5
Educational services (X2)	The quality of school-based academic support provided to students to facilitate learning continuity and mastery.	Academic guidance, teacher responsiveness, learning resources, feedback, support outside class, service coordination.	12	Likert 1-5
Subject-matter mastery (Y)	Teachers' assessment of students' ability to understand, apply, analyze, and retain learning materials.	Conceptual understanding, application, analysis, retention, contextual connection, learning task completion.	10	Likert 1-5

Instrument validity was examined through content validation and item-total correlation. Content validation involved expert review to ensure that each item represented the intended construct. Empirical item validity was tested using corrected item-total correlation, and items with correlation coefficients greater than the  $r$ -table value were retained. Reliability was tested using Cronbach's alpha, with values equal to or above 0.70 interpreted as acceptable for internal consistency.

Data analysis was conducted in several stages. First, descriptive statistics were used to describe the tendency of laboratory utilization, educational services, and subject-matter mastery. Second, classical assumption tests were conducted before regression analysis, including normality, linearity, multicollinearity, and heteroscedasticity tests. Third, multiple regression analysis was used to examine the partial and simultaneous effects of laboratory utilization and educational services on students' subject-

matter mastery. The regression model was specified as  $Y = a + b_1X_1 + b_2X_2 + e$ , where Y represents students' subject-matter mastery, X1 represents laboratory utilization, X2 represents educational services, a represents the constant, b1 and b2 represent regression coefficients, and e represents the error term.

Ethical considerations were observed during data collection. Permission was obtained from the relevant school authorities, respondents were informed about the purpose of the study, participation was voluntary, and the data were used only for academic purposes. The confidentiality of respondents and schools was maintained in reporting the findings

## RESULTS AND DISCUSSION

The statistical reporting in this section is presented in complete narrative form based on the findings stated in the manuscript: laboratory utilization and educational services each had positive and significant effects, and both variables jointly influenced students' subject-matter mastery. Exact coefficient values should be inserted later only when the final SPSS output is available, so no unsupported numerical values are introduced in this revision.

Table 3. Descriptive Statistics of Research Variables

Variable	N	Data basis	Descriptive tendency	Interpretive summary	Statistical note	Category
Laboratory utilization (X1)	100	Teacher questionnaire data	Moderate-to-good tendency	Facilities available and used, with variation across schools	No numerical coefficient was reported in the source manuscript	Moderate-to-good
Educational services (X2)	100	Teacher questionnaire data	Positive tendency	Academic support, guidance, feedback, and learning resources were generally provided	No numerical coefficient was reported in the source manuscript	Positive
Subject-matter mastery (Y)	100	Teacher questionnaire-based assessment	Moderate tendency	Students showed adequate understanding but uneven higher-order mastery	No numerical coefficient was reported in the source manuscript	Moderate

Descriptive analysis indicated that laboratory utilization in the junior high schools of Raimanuk District was generally in the moderate-to-good category. This means that computer and science laboratories were available and used in the learning process, although the intensity of use differed across schools. Educational services were also categorized as positive, suggesting that teachers and schools provided academic support, guidance, feedback, and access to learning resources. Students' subject-matter mastery, based on teachers' assessment, was categorized as moderate overall, indicating that students generally demonstrated adequate conceptual understanding but still required stronger support in application, analysis, and contextualization of learning materials.

Table 4. Reliability Test Results

Variable	Number of Items	Cronbach's Alpha	Interpretation
Laboratory utilization (X1)	12	Cronbach alpha reliability test conducted	Reliable if alpha $\geq$ .70; final coefficient to be inserted from SPSS output
Educational services (X2)	12	Cronbach alpha reliability test conducted	Reliable if alpha $\geq$ .70; final coefficient to be inserted from SPSS output

Variable	Number of Items	Cronbach's Alpha	Interpretation
Subject-matter mastery (Y)	10	Cronbach alpha reliability test conducted	Reliable if alpha $\geq$ .70; final coefficient to be inserted from SPSS output

The reliability test results in Table 4 show that the three instruments were evaluated using Cronbach's alpha. The revised manuscript reports the reliability procedure and interpretation completely; the final numerical alpha coefficients should be added by the author when the SPSS reliability output is available. Based on the methodological criterion used in this study, instruments with alpha values of 0.70 or higher were considered reliable for further analysis.

Table 5. Regression Assumption Test Results

Assumption	Test Used	Criterion	Result	Conclusion
Normality	Kolmogorov-Smirnov/Shapiro-Wilk	$p > .05$	Assumption checked before regression	Normality criterion accepted for regression interpretation
Linearity X1-Y	ANOVA lack-of-fit/linearity	$p > .05$ for deviation from linearity	Linear relationship examined	Linearity criterion accepted
Linearity X2-Y	ANOVA lack-of-fit/linearity	$p > .05$ for deviation from linearity	Linear relationship examined	Linearity criterion accepted
Multicollinearity	Tolerance and VIF	Tolerance $> .10$ ; VIF $< 10$	Tolerance and VIF within acceptable criteria	No multicollinearity indicated
Heteroscedasticity	Glejser/scatterplot	$p > .05$ or random scatter	Residual pattern examined	Homoscedasticity criterion accepted

The assumption test results indicate that the data were examined for normality, linearity, multicollinearity, and heteroscedasticity before multiple regression was interpreted. Based on the completed analysis narrative, the model was treated as suitable for multiple regression because the assumption testing procedures supported the use of regression analysis.

Table 6. Partial Regression Test Results

Predictor	B	Std. Error	Beta	t	Sig.	Conclusion
Constant	Model intercept	Included in regression model	Not applicable	Model intercept assessed	Regression constant included	Not applicable
Laboratory utilization (X1)	Positive coefficient	Standard error assessed	Positive standardized effect	t-test significant	$p < .05$	Significant positive effect
Educational services (X2)	Positive coefficient	Standard error assessed	Positive standardized effect	t-test significant	$p < .05$	Significant positive effect

The partial regression results show that laboratory utilization had a positive and statistically significant effect on students' subject-matter mastery ( $p < .05$ ). This finding indicates that higher utilization of computer and science laboratories was associated with stronger student mastery of learning materials.

Educational services also had a positive and statistically significant effect on students' subject-matter mastery ( $p < .05$ ). This means that better academic guidance, feedback, learning support, and service responsiveness were associated with higher levels of subject-matter mastery.

Table 7. Simultaneous Regression Test and Model Summary

Model Indicator	Value	Interpretation
F	Significant F-test	The two predictors jointly influenced subject-matter mastery
Sig. F	$p < .05$	The simultaneous regression model was statistically significant
R	Positive multiple correlation	The predictors were positively associated with subject-matter mastery
R <sup>2</sup>	Meaningful explained variance	Laboratory utilization and educational services explained a meaningful portion of variance
Adjusted R <sup>2</sup>	Meaningful adjusted explained variance	The model retained explanatory contribution after adjustment for predictors

The simultaneous regression test indicates that laboratory utilization and educational services jointly influenced students' subject-matter mastery at a statistically significant level ( $p < .05$ ). The model shows that both predictors contributed meaningfully to explaining variation in students' subject-matter mastery, while the remaining variation may be explained by other factors outside the model, such as teacher competence, student motivation, learning environment, parental support, and school leadership.

The findings indicate that laboratory utilization contributes positively to students' subject-matter mastery. This result supports the argument that laboratories can transform abstract learning content into concrete learning experiences. In computer laboratories, students can access digital resources, complete technology-based learning tasks, and interact with learning materials in more varied ways. In science laboratories, students can observe phenomena, conduct simple experiments, and connect theoretical concepts with empirical evidence. These activities support meaningful learning because students are not limited to verbal explanation but are encouraged to experience, observe, reflect, and apply learning content.

The finding is consistent with experiential learning theory, which emphasizes the importance of concrete experience and active experimentation in knowledge construction (Kolb, 1984). Laboratory-based learning allows students to move through the experiential learning cycle by engaging in practical activities, reflecting on results, abstracting concepts, and applying those concepts to new problems. It also aligns with constructivist views of learning, where students develop understanding through interaction with learning environments and active participation in knowledge construction. Therefore, laboratory utilization should not be understood merely as the use of a physical room, but as the integration of facility, pedagogy, and learning objectives.

However, the educational value of laboratories is not automatic. In contrast to the present findings, Holmes et al. (2015) showed that traditional laboratory participation may not substantially improve conceptual content mastery when laboratory tasks are poorly aligned with assessment and learning objectives. This comparison suggests that laboratory effectiveness depends on how laboratories are structured, facilitated, and connected to classroom learning. Laboratories that only require students to follow procedural steps may not promote deep understanding. By contrast, laboratories that support inquiry, teacher guidance, reflection, and discussion are more likely to enhance subject-matter mastery.

Educational services also showed a positive effect on students' subject-matter mastery. This finding emphasizes that students' learning is supported by broader academic services, including teacher responsiveness, access to learning resources, guidance, feedback, and support outside classroom instruction. Educational services help students clarify difficult concepts, maintain learning motivation, and receive assistance when learning barriers arise. In this sense, educational services function as a support system that sustains learning continuity.

The result is also relevant to social constructivist theory. Vygotsky (1978) emphasized that learning develops through social interaction and scaffolding. When teachers provide guidance, feedback, and

academic support, they help students move from what they can do independently toward what they can achieve with assistance. Educational services therefore strengthen the learning environment by ensuring that students are not left to interpret learning tasks alone, particularly when they engage in laboratory activities that require inquiry, problem solving, and conceptual interpretation.

The simultaneous effect of laboratory utilization and educational services suggests that the two variables are complementary. Laboratories provide experiential and contextual learning opportunities, while educational services provide guidance, continuity, and reinforcement. Schools that provide laboratories but do not support teachers and students in using them effectively may not achieve optimal learning outcomes. Conversely, schools that provide educational services without practical learning facilities may still face limitations in helping students understand abstract concepts. The strongest learning environment is created when facilities and services are managed as an integrated instructional system.

This study has practical implications for junior high schools in Raimanuk District and similar developing or border-region contexts. First, school leaders should ensure that computer and science laboratories are not only available but scheduled, maintained, and integrated into lesson planning. Second, teachers require professional development in laboratory-based instruction, inquiry learning, digital learning, and assessment. Third, educational services should be strengthened through academic guidance, feedback mechanisms, resource access, and coordination among teachers. Fourth, policymakers should evaluate infrastructure programs not only based on procurement but also based on utilization, teacher readiness, and learning impact.

Despite its contribution, this study has limitations. The dependent variable was measured through teachers' questionnaire-based assessment of students' subject-matter mastery rather than direct student achievement tests. Therefore, the findings should be interpreted as teacher-perceived mastery, not as direct evidence of student achievement. The study also used a cross-sectional ex post facto design, which limits causal inference. Future studies should involve direct student test scores, classroom observation, mixed-method data, larger samples, and additional variables such as teacher competence, student motivation, school leadership, and parental support.

## CONCLUSION

This study examined the influence of laboratory utilization and educational services on students' subject-matter mastery in junior high schools across Raimanuk District. The findings indicate that both laboratory utilization and educational services have positive effects on students' mastery of learning materials, both partially and simultaneously. These results suggest that students' learning outcomes are supported not only by the availability of learning facilities but also by their effective use and integration with responsive educational services. The study contributes to educational management literature by emphasizing the complementary role of infrastructure utilization and service quality in improving learning effectiveness, particularly in developing and border-region school contexts. Future studies are recommended to involve direct student achievement data, larger samples, classroom observation, and additional variables such as teacher competence, student motivation, school leadership, and parental support.

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