

Evaluation of The Google Sites-Based Stat-Tech Portal: Students' Learning Outcomes and Learning Experiences In Educational Statistics

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Article Information	ABSTRACT
Revised: July 2026	Digital learning that relies on multiple separate platforms may hinder students' structured access to learning materials and activities. To address this issue, the Google Sites-based STAT-TECH Portal was implemented as an integrated digital learning hub in an Educational Statistics course. This study aimed to analyze changes in students' learning outcomes before and after the implementation of the STAT-TECH Portal and to describe their learning experiences while using the portal. A quantitative approach with a one-group pretest-posttest design was employed, involving 39 students enrolled in an elementary teacher education program. The portal was implemented over seven class meetings. Data were collected through learning achievement tests administered before and after the implementation and a learning experience questionnaire administered at the end of the implementation. Learning outcome data were analyzed using descriptive statistics, the Shapiro-Wilk normality test, a paired-samples t-test, normalized gain, and effect size, while questionnaire responses were analyzed descriptively using percentages. The mean learning score increased from 65.55 to 84.54, with a statistically significant difference ($p < 0.001$), a moderate normalized gain of 0.49, and a large effect size (Cohen's $d = 1.397$). Thirty students completed the questionnaire, resulting in an overall learning experience score of 89.73%, categorized as very good. These findings indicate that the implementation of the STAT-TECH Portal was accompanied by improved learning outcomes and positive learning experiences. However, given the absence of a control group, the observed improvement cannot be attributed solely to the portal. The findings suggest that the STAT-TECH Portal has the potential to serve as an integrated digital learning hub that facilitates structured access to learning resources and activities in Educational Statistics. Keywords: Educational Statistics, Google Sites, learning experience, learning outcomes, STAT-TECH Portal © 2026 Eva Setya Rini, Shara Rafiq Nurulcholillah Sukri, Nina Arfiani, Hasna Hasanuddin, Endrawan Budi Prakosa. Published by Institute for Research and Community Services Universitas Muhammadiyah Palangkaraya. This is Open Access article under the CC-BY-SA License (http://creativecommons.org/licenses/by-sa/4.0/).
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INTRODUCTION

Digital transformation has changed the way teaching and learning are organized in higher education. Technology is no longer used merely to deliver information but has become part of the learning environment that enables students to access learning materials and activities more flexibly. In preservice teacher education, this integration is particularly relevant because students need experience in using technology to support their learning. Appropriate use of digital media can provide greater opportunities for flexible and independent learning (Supit & Ridwan, 2022). However, the use of multiple separate platforms may create difficulties in organizing learning activities. Course materials, instructional videos, assignments, assessments, and other information may be distributed across different applications. A similar condition occurred in the Educational Statistics course prior to the implementation of the STAT-TECH Portal, requiring students to access several platforms to obtain learning resources and participate in course activities (Rini, 2026).

Google Sites provides an alternative for organizing various learning resources within a single web-based environment. The platform allows materials, documents, videos, forms, and learning links to be integrated and accessed through different devices. In mathematics education, Google Sites has been used to develop learning media for arithmetic sequences (Ciung et al., 2022) and systems of linear equations in two variables (Arnisa et al., 2025). Its development has also extended beyond content delivery. (Fidalia et al., 2025), for example, developed interactive Google Sites-based media integrated with discovery learning to facilitate mathematical problem solving skills. These studies demonstrate the flexibility of Google Sites in organizing learning resources and supporting mathematical learning activities.

Previous studies have demonstrated the potential of Google Sites to support mathematics learning across various instructional contexts, including web-based learning, instructional strategies, project-based learning, and problem-based learning ((Purba et al., 2022); (Nugraha et al., 2023); (Lamaka et al., 2023);(Wulandari & Isnarto, 2023);(Fauziyah & Martiningsih, 2025); (Pakih & Maulani, 2026)). Collectively, these findings indicate that Google Sites can provide a useful digital environment for supporting mathematics learning.

In a context more closely related to the present study, (Buchori et al., 2023) developed Google Sites-based mathematics learning materials for statistics and demonstrated their potential to support conceptual understanding. However, studies on Google Sites in mathematics education have predominantly focused on media development, feasibility, and learning effectiveness (Nursaidah & Mustafa, 2026). This indicates the need to examine Google Sites beyond its use as a medium for specific learning content, particularly as an integrated digital environment used throughout the learning process.

Evaluation of an integrated digital learning environment should consider not only learning outcomes but also students' learning experiences. Previous studies have highlighted user experience and student perceptions as important dimensions in evaluating Google Sites-based learning (Ayuni & Pramuditya, 2026); (Annisa et al., 2026).Thus, learning outcomes and learning experiences provide complementary perspectives for evaluating digital learning implementation.

In this study, Google Sites was used as the platform for the STAT-TECH Portal, an integrated digital learning hub that brings together course materials, instructional videos, exercises, assignments, assessments, and supporting resources for Educational Statistics. The portal was designed to provide students with a centralized point of access to learning resources and activities. An earlier implementation of the STAT-TECH Portal showed positive student responses regarding ease of use, organization of learning activities, support for independent learning, and accessibility of learning materials (Rini, 2026). However, the earlier evaluation was limited to a training settings, with evidence derived from observations and descriptively analyzed questionnaire responses. Consequently, it did not examine whether students' learning outcomes changed after STAT-TECH was incorporated into regular course instruction.

Despite the growing use of Google Sites in mathematics education, limited attention has been given to its use as an integrated digital learning hub that organizes multiple learning components throughout an Educational Statistics course. Furthermore, previous studies have rarely evaluated both changes in students' learning outcomes and their learning experiences within such an integrated environment. This study addresses this gap by evaluating the STAT-TECH Portal as an integrated digital learning hub through these two complementary dimensions. This integrated evaluation constitutes the novelty of the present study.

Therefore, this study examined how students' learning outcomes differed between the pre-implementation and post-implementation measurements and described their experiences of using STAT-TECH in the Educational Statistics course. The findings are expected to provide an empirical basis for improving the portal and to contribute to the implementation of integrated digital learning environments in preservice elementary teacher education.

METHOD

This study employed a quantitative approach with a one-group pretest-posttest design. The design was used to examine changes in students' learning outcomes before and after the implementation of the Google Sites-based STAT-TECH Portal. In addition to learning outcomes, students' learning experiences were evaluated after using the portal. The research design consisted of an initial measurement (O₁), implementation of learning using the STAT-TECH Portal (X), and a final measurement (O₂), as presented in

Table 1. Research Design

Group	Pretest	Treatment	Posttest
One group	O ₁	X	O ₂

Note: O₁ = pretest of learning outcomes; X = learning using the STAT-TECH Portal; O₂ = posttest of learning outcomes.

Because the study involved only one group without a control group, differences between the pretest and posttest scores were interpreted as changes observed after the implementation of the STAT-TECH Portal and were not intended to establish an absolute causal relationship between the portal and students' learning outcomes.

The study was conducted in the Educational Statistics course in the Elementary School Teacher Education Study Program, Faculty of Teacher Training and Education, Tadulako University, during the fourth semester of the 2025-2026 academic year. The population consisted of 39 students enrolled in one class. All members of the population were included in the study; therefore, total sampling was employed. All 39 students completed both the pretest and posttest. The learning experience questionnaire was administered to all students after the implementation of the STAT-TECH Portal; however, 30 students (76.92%) provided complete responses. Consequently, the learning outcome analysis was based on 39 paired pretest-posttest scores, whereas the learning experience analysis was based on 30 complete questionnaire responses.

The study was conducted over seven class meetings. Before the implementation of the STAT-TECH Portal, students completed a pretest to obtain baseline data on their learning outcomes. Students subsequently participated in Educational Statistics learning activities using the STAT-TECH Portal as a centralized access point for learning materials and activities. The portal integrated course

materials, presentation materials, instructional videos, exercises, assignments, assessments, and supporting learning resources. After the seven-meeting implementation period, students completed a posttest to measure their learning outcomes. At the end of the implementation, the learning experience questionnaire was administered to obtain information about students' experiences while using the portal.

Data collection involved a learning achievement test and a questionnaire on students' learning experiences. The achievement test comprised five essay items with a total possible score of 100 and was used for both pretest and posttest measurement. The researcher, who also taught the Educational Statistics course, developed the test by referring to the course content, learning indicators, and stated learning objectives. Each test item was reviewed by the researcher for its alignment with the intended learning indicators and course content, clarity of wording, and appropriateness of the level of difficulty. Independent expert validation was not conducted.

The empirical quality of the five test items was examined using corrected item-total correlations. The coefficients obtained for Items 1, 2, 3, 4, and 5 were 0.740, 0.731, 0.795, 0.724, and 0.665, respectively. All coefficients exceeded the predetermined criterion of 0.30, indicating that the five items met the item-quality criterion.

For the scoring procedure, the five essay items were assigned different maximum scores based on the learning indicators and the complexity of the responses required. The maximum scores were 10 points for Item 1, 15 points for Item 2, 20 points for Item 3, 25 points for Item 4, and 30 points for Item 5, resulting in a maximum total score of 100. Each response was evaluated according to item specific scoring criteria that considered both the correctness and completeness of the answer. The scores obtained from the five items were summed to produce a total score ranging from 0 to 100.

The reliability of the learning achievement test was examined using Cronbach's alpha. The analysis yielded a coefficient of 0.852, indicating good internal consistency of the five-item test.

Students' learning experiences were assessed through a 10 item questionnaire using five response options ranging from strongly agree to strongly disagree. The questionnaire covered three aspects: ease of use and accessibility, support for the learning process, and usefulness and acceptance of the portal. The questionnaire was administered after the implementation of the STAT-TECH Portal. Item Quality of the learning experience questionnaire was examined using the corrected item total correlation based on responses from 30 students. An item was considered valid when the corrected item total correlation coefficient was greater than 0.30. The analysis showed that all 10 questionnaire items met the validity criterion, with corrected item total correlation coefficients ranging from 0.391 to 0.676. The internal consistency of the questionnaire was assessed using Cronbach's alpha, yielding a coefficient of 0.833, indicating good internal consistency. These results provide empirical evidence that the questionnaire demonstrated adequate item validity and reliability for assessing students' learning experiences with the STAT-TECH Portal.

Learning outcome data were analyzed using descriptive statistics, including minimum and maximum scores, mean, and standard deviation. Before testing differences between the two measurements, the normality of the difference scores between the pretest and posttest was examined using the Shapiro-Wilk test. When the normality assumption was satisfied, differences in learning outcomes were analyzed using a paired-samples t-test at a significance level of 0.05. If the normality assumption was not satisfied, the Wilcoxon signed rank test was specified as the non parametric alternative. A paired analysis was used because the pretest and posttest measurements were obtained from the same students. The magnitude of improvement in learning outcomes was analyzed using normalized gain (N-Gain), which compares the actual gain with the maximum possible gain (Hake, 1998):

$$g = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

The N-Gain values were interpreted as high when $g > 0.70$, moderate when $0.30 \leq g \leq 0.70$, and low when $g < 0.30$.

In addition to N Gain, an effect size was calculated to describe the magnitude of the change in students' learning outcomes. Statistical significance alone does not directly indicate the magnitude of a difference. Therefore, reporting an effect size provides complementary information regarding the observed change. For paired data, effect size calculation should take into account the characteristics of a within subject design (Lakens, 2013). Cohen's d was used and interpreted using the conventional benchmarks of 0.20 = small, 0.50 = medium, and 0.80 = large. Students' learning experience data were analyzed descriptively using mean scores and percentages. Responses were scored as 5 for Strongly Agree, 4 for Agree, 3 for Neutral, 2 for Disagree, and 1 for Strongly Disagree. Percentages were calculated for each aspect and for the questionnaire overall. The resulting percentages were categorized as 81-100% = very good, 61-80% = good, 41-60% = fair, 21-40% = poor, and 0-20% = very poor. The questionnaire findings were used to describe students' learning experiences and were subsequently interpreted alongside the observed changes in learning outcomes.

The study was conducted within the regular Educational Statistics learning context. Students' identities and data confidentiality were protected throughout data processing and reporting. The findings were reported in aggregate form without disclosing individual student identities.

RESULT

Learning Outcomes

The STAT-TECH Portal was implemented for seven meetings in the Educational Statistics course. The portal served as an integrated learning environment that provided students with access to learning materials, presentation slides, instructional videos, exercises, assignments, evaluations, and supporting learning resources. Students' learning outcomes were assessed at two measurement points, before and after the implementation. Tabel II summarizes the resulting descriptive statistics.

Table II. Descriptive Statistics of Students' Learning Outcomes

Measurement	N	Minimum	Maximum	Mean	SD
Pretest	39	1.20	91.40	65.55	18.29
Posttest	39	24.50	93.30	84.54	13.44

Table II shows an 18.99 point difference between the mean pretest score (65.55) and the mean posttest score (84.54). the minimum score changed from 1.20 to 24.50, whereas the maximum score changed from 91.40 to 93.30. Overall, the descriptive results show higher student performance at posttest than pretest. Before testing the difference between the pretest and posttest scores, the normality of the difference scores was examined using the Shapiro-Wilk test. The results are presented in Table III.

Table III. Shapiro Wilk Normality Test of Pretest Posttest Difference Scores

Data	Shapiro Wilk	df	Sig.	Interpretation
Pretest-posttest difference scores	0.962	39	0.201	Normal

A Saphiro wilk significance value of 0.201 was obtained. Because this value exceeded 0.05, the pretest-posttest difference scores met the normality assumption.

Table IV. Paired-samples t-test Results

Comparison	Mean Difference	Test Statistic	df	Sig.
Pretest - Posttest	-18.99	$t = -8.726$	38	<0.001

Posttest scores were significantly higher than pretest scores, as indicated by the paired samples t test, $t(38) = -8.726, p < 0.001$. N-Gain and Cohn's d were subsequently used to describe the magnitude of the observed change, as summarized in Table V.

Table V. N Gain and Effect Size of Students' Learning Outcomes

Analysis	Value	Category
N-Gain	0.49	Moderate
Cohen's d	1.397	Large

The N-Gain value of 0.49 fell within the moderate category, whereas the Cohen's d value of 1.397 corresponded to a large effect size. Thus, the observed pretest posttest change was both statistically significant and large in magnitude.

Students' Learning Experiences Using the STAT-TECH Portal

In addition to learning outcomes, students' learning experiences were evaluated after using the STAT-TECH Portal. The questionnaire was administered to all 39 students; however, only 30 students (76.92%) provided complete responses, while the remaining nine students submitted incomplete questionnaire responses. The incomplete responses were excluded from the analysis; therefore, the learning experience analysis was based on 30 complete questionnaire responses. The results are presented in Table VI.

Table VI. Students' Learning Experiences Using the STAT-TECH Portal

Aspect	Mean	Percentage (%)	Category
Ease of use and accessibility	4.51	90.17	Very Good
Support for the learning process	4.55	91.00	Very Good
Usefulness and acceptance of the portal	4.32	86.33	Very Good

Overall	4.49	89.73	Very Good
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The overall mean score for students' learning experiences was 4.49, equivalent to 89.73%, and was categorized as very good. Support for the learning process received the highest score ($M = 4.55$; 91.00%), followed by ease of use and accessibility ($M = 4.51$; 90.17%). Usefulness and acceptance of the portal received the lowest score among the three aspects ($M = 4.32$; 86.33%), although it remained within the very good category. At the item level, the statement that the portal helped make learning more structured obtained the highest percentage (92.67%), while 96.7% of respondents agreed or strongly agreed that they would use the portal again.

Discussion

Students demonstrated higher learning performance during the period in which STAT-TECH was implemented. Their mean score changed from 65.55 at pretest to 84.54 at posttest, with the difference reaching statistical significance, $t(38) = -8.726, p < 0.001$. the N-Gain value was 0.49 (moderate), while Cohen's d reached 1.397 (large). Together, these indicators describe the extent of change in students' performance across the two measurements. However, the study did not include a comparison or control group; therefore, the increase observed during the implementation period should not be interpreted as evidence that STAT-TECH alone caused the change.

The improvement in learning outcomes can be understood in relation to the characteristics of the STAT-TECH Portal as an integrated digital learning environment. Rather than requiring students to access learning resources through separate platforms, STAT-TECH organizes learning materials, presentation slides, instructional videos, exercises, assignments, evaluations, and supporting resources within a single access point. This centralized arrangement allows students to return to particular materials and access resources according to their learning needs. This feature is particularly relevant to Educational Statistics, in which students are expected not only to perform statistical procedures but also to understand concepts and interpret analytical results. This finding is consistent with (Muhammad et al., 2025), who demonstrated the potential of Google Sites-based learning in supporting students' self-determination.

The integration of different learning formats may also provide students with greater flexibility in managing their learning activities. Written materials can support conceptual and procedural understanding, instructional videos allow students to revisit explanations, while exercises and evaluations provide opportunities to monitor their understanding. This interpretation is consistent with (Gessa et al., 2025), who reported that Google Sites can integrate instructional videos, activity sheets, and quizzes within a single digital environment, while demonstrating high practicality and positive student engagement. Therefore, the educational value of Google Sites is not merely associated with its function as a website, but with how learning components are structured and integrated within the platform.

Similar patterns have been reported in earlier research on the use of google sites for mathematics instruction. (Desika et al., 2025) reported positive learning outcomes following the use of interactive Google Sites-based media. Similarly, (Fauziyah & Martiningsih, 2025) found a significant difference between students who learned using Google Sites and those who did not ($p = 0.007$). (Sari et al., 2025) also demonstrated that Google Sites-based learning media could support students' cognitive learning outcomes while demonstrating a high level of practicality for both teachers and students. Although these studies differ in educational level, participants, instructional content, and research design, the consistency of the findings indicates the potential of Google Sites as a digital environment for supporting mathematics learning.

Evidence from a study involving a comparison group further supports this interpretation. (Ramanda et al., 2025) found that integrating Google Sites with Student Teams Achievement Division (STAD) cooperative learning resulted in greater improvement in mathematical conceptual understanding than that observed in the comparison group. This finding suggests that the effectiveness of Google Sites is influenced not only by the technological platform itself but also by the instructional design and the way digital resources are incorporated into learning activities.

The N-Gain value of 0.49 obtained in this study represents a moderate normalized improvement. This value was lower than the N-Gain of 0.78 reported by (Tantiyah & Indrawati, 2025). However, such differences should not be interpreted as direct evidence that one implementation is superior to another because the studies involved different educational levels, subject matter, participant characteristics, and instructional procedures. Although the normalized gain was classified as moderate, the pretest posttest difference produced a large effect size (Cohen's $d = 1.397$). These findings are not contradictory because the two measures capture different aspects of improvement. N-Gain reflects the proportion of the maximum possible improvement achieved by students, whereas Cohen's d expresses the magnitude of the pretest–posttest difference relative to the variability of the scores. Thus, although students achieved a moderate proportion of the possible improvement, the observed increase in scores was large relative to the variability in their performance. Taken together, the two measures indicate a substantial pretest posttest change, although the moderate N-Gain suggests that students had not yet reached the maximum improvement that was theoretically possible.

Similar evidence has been reported in more recent studies. (Marfuatin & Yuliastuti, 2026) found a high N Gain and highly positive user responses toward Google Sites-based learning media, while (Rahmawati et al., 2026) reported that the posttest mean of students using Google Sites-based mathematics media was higher than that of the comparison group. Furthermore, the systematic review conducted by (Nursaidah & Mustafa, 2026) showed that studies on Google Sites in mathematics education have frequently focused on learning outcomes, motivation, and learning interest, although much of the existing literature remains oriented toward media development and validation.

The relevance of Google Sites to statistics learning has also been demonstrated in previous research. (Zendrato et al., 2025) showed that Google Sites can be used to organize digital statistics learning to support numeracy skills, while (Sholikhah & Lestari, 2025) developed contextual Google Sites-based media for statistics instruction. These findings provide contextual support for STAT-TECH because statistics learning benefits from the integration of conceptual explanations, worked examples, instructional videos, exercises, assignments, and evaluations within an organized digital environment.

In addition to improved learning outcomes, students reported highly positive learning experiences with the STAT-TECH Portal. The overall mean was 4.49 (89.73%), categorized as very good. Support for the learning process obtained the highest percentage (91.00%), followed by ease of use and accessibility (90.17%) and usefulness and acceptance of the portal (86.33%). These findings indicate that students not only perceived the portal as accessible but also considered its structure supportive of their learning activities. This finding is consistent with (Ayuni & Pramuditya, 2026), who emphasized the importance of design, accessibility, and user experience in evaluating Google Sites-based digital learning materials.

Positive student experiences are also consistent with (Ardila & Samosir, 2024), who reported favorable student responses to the accessibility of Google Sites-based learning, and (Ali et al., 2024), who showed that Google Sites can provide a structured space for organizing learning materials, assignments, and students' work. Similarly, (Khaebibah & Pramuditya, 2026) positioned accessibility and user experience as important dimensions in evaluating Google Sites as a digital mathematics learning center, while (Dewi & Rusmining, 2025) reported favorable validity and practicality results for Google Sites-based mathematics learning media.

The learning experience data complement the pretest posttest findings by providing a different perspective on the implementation of STAT-TECH. The achievement data describe changes in students' academic performance, whereas the questionnaire data describe how students experienced the portal during the learning process. These two forms of evidence should therefore be interpreted as complementary rather than causal. Positive perceptions cannot be assumed to have directly caused higher learning outcomes, nor can increased scores alone explain students' positive experiences with the portal.

The present findings also extend the preliminary evaluation of the STAT-TECH Portal conducted by (Rini, 2026), which identified positive student responses regarding ease of use, learning organization, support for independent learning, and access to instructional materials. The present study differs from that preliminary evaluation because STAT-TECH was implemented for seven meetings as part of actual Educational Statistics instruction. Therefore, students' positive experiences in the present study reflect their experience after sustained use of the portal rather than merely their impressions following its introduction or initial training.

This study contributes by evaluating STAT-TECH in the context of its sustained use during regular educational statistics instruction. Unlike studies that primarily develop and evaluate a Google Sites product for a particular topic, STAT-TECH was used as an integrated digital learning center combining instructional materials, presentation slides, videos, exercises, assignments, evaluations, and supporting resources throughout the learning process. In this context, Google Sites functions not merely as a medium for content delivery but as a tool for learning organization. Furthermore, this study combines evidence of changes in learning outcomes with students' learning experiences after sustained portal use. This approach provides a more comprehensive perspective on implementation without assuming that positive experiences automatically cause improved learning outcomes or vice versa.

Despite these positive findings, several limitations should be acknowledged. Participants were limited to a single class of 39 students, and no control group was available for comparison. Accordingly, the observed changes in learning outcomes cannot be interpreted as effects produced solely by STAT-TECH. In addition, complete learning experience questionnaire data were obtained from 30 students, representing 76.92% of the participants, while nine students submitted incomplete questionnaire responses that were excluded from the analysis. The exclusion of these incomplete responses may have introduced response bias, as the learning experiences of these students may differ from those of the students included in the analysis. Therefore, the questionnaire findings may not fully represent the learning experiences of all students in the class. Future studies should involve multiple classes or comparison groups and may incorporate portal usage data, such as access frequency, frequently visited sections, and duration of use. Such evidence would provide a stronger basis for examining how patterns of portal use are associated with students' learning outcomes and experiences.

CONCLUSION

The evaluation of STAT-TECH showed higher student learning outcomes after its implementation, together with positive learning experiences. The mean score changed from 65.55 at pretest to 84.54 at posttest, while the N-Gain value of 0.49 was classified

as moderate and Cohen's d of 1.397 was classified as large. Students also reported highly positive experiences with the portal, with an overall score of 89.73% in the very good category. However, without a control group for comparison, the observed changes cannot be interpreted as effects caused exclusively by STAT-TECH.

This study provides evidence from the evaluation of STAT-TECH as a centralized digital environment that integrates course materials, instructional videos, exercises, assignments, assessments and supporting resources. By examining both learning outcomes and students' learning experiences, this study provides complementary evidence regarding the implementation of an integrated digital learning environment in Educational Statistics. In practice, the portal can be further developed, particularly by improving aspects related to its usefulness and user acceptance. Future studies should involve larger samples and multiple classes, include a comparison or control group, and incorporate user activity data to provide stronger evidence regarding the contribution and patterns of portal use in supporting student learning.

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