Effectiveness of the Self-paced Learning Module in Probability and Statistics for Future Mathematics Educators

Adriel G. Roman[1]

[1]College of Teacher Education, Laguna State Polytechnic University

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ABSTRACT:
This study tries to determine the effectiveness of a self-paced learning module in the instructional delivery of a mathematics course, particularly, Elementary Statistics and Probability. The study uses the descriptive-correlation design that focuses on two major aspects: first is the evaluation of the students after they utilize the checked, validated, and reliability-tested Self-paced learning module in Elementary Statistics and Probability. Twenty-three mathematics major students (working students and full-time students) were chosen purposively. Respondents were asked to answer a 30-item survey about the SLM. Based on the findings, the SLM in Elementary Statistics and Probability is effective, as proven by the converging results of students' evaluations, average quiz scores, and final academic performance in the course. Introductory topics in the course were noted at the top, while topics focused on measures of central tendency (variability) were found at the bottom of the competencies. Five characteristics of the SLM were also found to correlate with the final academic performance of the students, such as theoretical knowledge to practice; creativity in teaching approaches; alignment of assessment to the learning objectives; visuals and design; and reflective gender equality in examples and illustrations.

Keywords: Self-paced Learning Modules, Elementary Statistics, Probability, Inclusive

1. Introduction

Tertiary education requires a lot of time and effort. In college, there are two types of students: full-time and working. It is ideal that an individual in a collegiate level is a full-time student. In this scenario, students can focus on their studies and devote their time to reviewing their lessons, doing advanced reading, and researching. However, in reality, some individuals cannot devote their time fully to studying lessons. Some students work while studying, in addition to performing responsibilities at their respective homes. In this scenario, the time schedule of students is not fully focused on studying (Lessky & Unger, 2023). In the case of the Bachelor of Secondary Education major in Mathematics, where students aspire to become Mathematics teachers, students are expected to exhibit competence in mathematical concepts and procedures; demonstrate competence in problem-solving by solving and creating routine and non-routine problems with different levels of complexity. This program demands more time from students, and in one of its courses, Elementary Statistics & Probability, which is both perceived as a difficult subject (Kandeel, 2019; Yusuf, Rahim, & Eu, 2022; Salvador & Supan, 2022), and with limited understanding of concepts (Makwakwa, Mogari, & Ogbonnaya, 2024), students are expected to be

equipped with basic statistical tools to understand various phenomena. Students are likewise expected to perform data analysis with computation carried out in statistical software (CMO 75, s 2017). However, because of their abstract nature, mathematical complexity, and the cognitive demands involved in interpreting uncertainty and variability, these subjects are frequently seen as conceptually challenging. As a result, learner-centered teaching strategies that let students progress at their own speed while encouraging conceptual comprehension, autonomous learning, and self-control are becoming more and more important.

Given the types of college students and the need of the course, mathematics instructors/professors need to provide support to both types of college students by giving them materials that can assist them in achieving the intended learning outcomes while making the learning space more inclusive among students. Such materials include the self-paced learning module.

A self-paced learning module is a tool designed to facilitate learning through mastery of knowledge or process/procedure (Bustoba & Cruz, 2022). This material can be in the form of printed or electronic, which can be given to various types of learners (Santillan, 2023). A self-paced learning module is found to have a positive impact on students' academic behavior, specifically focus and motivation (Bicoy et al.2025), mathematical communication skills (Kasih & Siregar, 2024) that lead to meaningful mathematics learning. Self-paced learning modules provide an avenue for students to facilitate their own learning in their own time outside school hours and thus are considered useful as they help students understand the lessons (Cabral, 2023). It likewise plays a role in enhancing the meta-cognitive aspects of teachers (Hamzah, Hamzah, & Zulkifli, 2022). This study aims to determine the effectiveness of a Self-Paced Learning Module in Elementary Statistics and Probability for future mathematics teachers. Specifically, it seeks to evaluate the extent to which the module improves students' academic performance, conceptual understanding, and mastery of statistical and probabilistic concepts. The study also intends to determine whether significant differences exist in the different components of the self-paced learning module.

Objectives

This study seeks to determine the effectiveness of a self-paced learning module in the instructional delivery of a mathematics course, particularly, Elementary Statistics and Probability, as reflected in students' evaluations, average quiz score per topic, and final rating in the course. Likewise, this study tests the relationship between the students' evaluations on their average quiz score per topic, and their final rating in the course. Further, the study tests the different on the different parameters of students' evaluations such as: content quality and relevance; instructional design and organization; learning activities and engagement; assessment and feedback; usability and accessibility; and gender and development (GAD) sensitivity.

2. Methodology

This study adopts the descriptive-correlation design that focuses on two major aspects: first is the evaluation of the students after they utilize the checked, validated, and reliability-tested Self-paced learning module in Elementary Statistics and Probability (Roman, 2016; Roman, 2020). Second is the test of effectiveness as reflected in students' average quiz score per topic, and their final grade in the course.

Twenty-three mathematics majors (working and full-time students) enrolled during the first semester of AY 2025-2026 at One State University in the Philippines participated in the study, selected through purposive sampling, as they are the future mathematics teachers. In their class, the professor provided the soft copy of the validated and reliability-tested module. After being informed about confidentiality and other rights as respondents in the study, the researcher asked for consent for their previous quiz scores and final grades to be used in the research, and presented not individually but in combination. They are likewise informed by the researcher about the result before submitting the research paper for publication.

The research instrument used in the paper consists of 30 items developed by the researcher, patterned on the evaluation instrument used by Roman (2016). The instrument was then validated by 5 research experts at the same university where the study was conducted before administering it to the target respondents. The instrument consists of 30 items divided into 6 different constructs, namely: content quality and relevance; instructional design and organization; learning activities and engagement; assessment and feedback; usability and accessibility; and gender and development (GAD) sensitivity. To interpret the weighted mean, the following was used by the researcher:

Scale:	Range	Description
5– Strongly Agree	4.50 – 5.00	Indicates that the respondent fully affirms that the statement is consistently evident in the instructional module and has a very high level of effectiveness.
4 – Agree	3.50 – 4.49	Indicates that the respondent generally affirms the statement and perceives the instructional module as effective in most aspects.
3– Neutral	2.50 – 3.49	Indicates that the respondent is uncertain or has a balanced view, suggesting that the effectiveness of the instructional module is moderate or inconsistent.
2 – Disagree	1.50 – 2.49	Indicates that the respondent generally does not affirm the statement and perceives limited effectiveness of the instructional module.
1– Strongly Disagree	1.00– 1.49	Indicates that the respondent completely rejects the statement and perceives the instructional module as ineffective or lacking in the specified aspect.

Overall, McDonald's omega value as a measure of reliability exceeds the reliability threshold of 0.70. Since the study included students' scores in their quizzes, the module developed by the researcher Roman (2016), Roman (2020) was modified with the inclusion of previous recommendations of the pilot students (during the previous academic year). To ensure alignment with the curriculum standards of the university, the self-paced learning module was subjected to the University Cluster Curriculum Review Committee (UCCRC) evaluation, which consisted of the Subject Matter experts, Lead Experts, Program Coordinator, Dean, Innovation and Technology Support Office (ITSO), Gender and Development Unit, the Curriculum Instruction and Development director, and the Vice President for Academic Affairs.

Evaluation of the UCCRC on the Developed Self-Paced Module in Elementary Statistics and Probability

Parameter	Weighted Mean	Verbal Interpretation
Organization and Presentation	4.00	Very Satisfactory
Assessment	4.00	Very Satisfactory
Inclusivity and Gender Sensitivity	3.90	Very Satisfactory
Intellectual Property and Data Privacy	3.90	Very Satisfactory
Overall	**3.95**	**Very Satisfactory**

The researcher likewise secured a certificate of utilization from the CID unit and further secured permission to conduct the study from the University President, through the office of the Research and Development Office. To gather the necessary data from the respondents, the researcher floated the validated survey instrument through Google Forms after the academic year and further sought permission from the students to use the quiz scores and final rating in the course. The study lasted one academic year before completion. Descriptive and inferential statistics were used to analyze data for each objective. The alpha level of significance is set at 5%.

3. Results

Students' Evaluation on the Characteristics of Self-Paced Learning Module in Elementary Statistics and Probability

Based on the results, the module obtained an Average Weighted Mean (AWM) of 4.83, indicating that respondents strongly perceived its content as accurate, relevant, and appropriate for their academic preparation. Among the indicators, "The topics are relevant to my future role as a teacher" received the highest mean (WM = 4.96), implying that respondents recognized the module's strong alignment with the competencies expected of future mathematics educators. This result suggests that the module effectively bridges theoretical knowledge and professional practice, enabling preservice teachers to appreciate the practical applications of Probability and Statistics in classroom instruction.

Similarly, the high ratings for clarity of concepts (4.83), alignment with course objectives (4.83), and accuracy of information (4.78) indicate that the instructional content possesses high academic quality and curricular relevance. The slightly lower rating for the integration of real-life classroom situations (4.74), although still interpreted as Very Effective, suggests an opportunity to enrich the module with additional authentic teaching scenarios. For the second construct, instructional design and organization, the module received an overall weighted mean of 4.78, indicating that respondents found its instructional organization highly satisfactory.

The highest ratings were observed in the indicators concerning organization of lessons (4.87) and the use of appropriate teaching strategies (4.87). These results imply that the module follows a logical sequence that facilitates independent learning and cognitive development. The relatively lower score for promoting independent learning (4.61) remains within the Very Effective range but indicates that while learners generally feel capable of studying independently, there is still room to strengthen learner autonomy through additional reflective activities, learning checkpoints, or self-monitoring tools.

Considering the third construct, the learning activities component achieved an Average Weighted Mean of 4.75, reflecting respondents' strong agreement that the module promotes meaningful engagement. The highest-rated indicator was "The activities help me apply theoretical knowledge to practice" (WM = 4.87), demonstrating that respondents considered the learning tasks authentic and applicable to future teaching situations. In particular, Critical thinking (4.74), collaborative learning (4.70), and creativity in teaching approaches (4.78) were also rated highly, suggesting that the module extends beyond rote learning and encourages higher-order thinking skills.

Assessment and feedback received an Average Weighted Mean of 4.83, indicating that respondents perceived the evaluation component as highly effective. The highest means were recorded for assessment alignment with learning objectives (4.87) and the inclusion of varied assessment methods (4.87). This indicates that respondents recognized the assessments as comprehensive and supportive of learning. The consistently high ratings for fairness (4.83), constructive feedback (4.83), and opportunities for self-reflection (4.74) demonstrate that the module incorporates principles of formative assessment that encourage continuous learning improvement.

The usability and accessibility construct showed an Average Weighted Mean of 4.79, indicating that respondents considered it highly accessible and easy to use. The highest rating was given to visuals and design elements enhancing understanding (WM = 4.91), suggesting that the module effectively uses visual representations to support learning. The module also received favorable ratings for user-friendliness (4.83), language clarity (4.78), accessibility in both print and digital formats (4.78), and accommodation of different learning styles (4.65).

Finally, among all dimensions, Gender and Development (GAD) Sensitivity recorded the highest overall rating with an Average Weighted Mean of 4.88, indicating outstanding performance in promoting inclusive education. The highest individual mean (WM = 4.96) was obtained by the indicator stating that the content promotes respect for diversity and inclusivity. Likewise, respondents strongly agreed that the module uses gender-fair language (4.91), presents gender-equal illustrations (4.91), avoids stereotypes (4.78), and prepares future teachers for gender-sensitive classroom practices (4.83). These results suggest that the module aligns with the principles of equitable education and prepares future teachers to create inclusive learning environments.

Table 1. Students' Evaluation on the Characteristics of Self-Paced Learning Module in Elementary Statistics and Probability.

A. Content Quality and Relevance	**WM**	**VI**
The module presents concepts clearly and logically.	4.83	Very Effective
The content aligns with the learning objectives of the course.	4.83	Very Effective
The module provides accurate and up-to-date information.	4.78	Very Effective
The topics are relevant to my future role as a teacher.	4.96	Very Effective
The module integrates real-life classroom situations.	4.74	Very Effective
AWM	**4.83**	Very Effective
B. Instructional Design and Organization	**WM**	**VI**
The module is well-organized and easy to follow.	4.87	Very Effective
Instructions for activities are clear and understandable.	4.74	Very Effective
The module uses appropriate teaching strategies for diverse learners.	4.87	Very Effective
The pacing of the lessons is appropriate.	4.83	Very Effective
The module promotes independent learning.	4.61	Very Effective
AWM	**4.78**	Very Effective
C. Learning Activities and Engagement	**WM**	**VI**
The activities in the module are engaging and interactive.	4.65	Very Effective
The tasks encourage critical thinking and reflection.	4.74	Very Effective
The module provides opportunities for collaborative learning.	4.7	Very Effective
The activities help me apply theoretical knowledge to practice.	4.87	Very Effective
The module encourages creativity in teaching approaches.	4.78	Very Effective
AWM	**4.75**	Very Effective

D. Assessment and Feedback	**WM**	**VI**
The assessments align with the learning objectives.	4.87	Very Effective
The module includes varied forms of assessment (e.g., quizzes, tasks, reflections).	4.87	Very Effective
The assessment tasks are fair and appropriate for my level.	4.83	Very Effective
Feedback mechanisms in the module help improve my learning.	4.83	Very Effective
The module allows self-assessment and reflection.	4.74	Very Effective
AWM	**4.83**	Very Effective
E. Usability and Accessibility	**WM**	**VI**
The module is user-friendly and easy to navigate.	4.83	Very Effective
The language used in the module is clear and comprehensible.	4.78	Very Effective
The module can be easily accessed in different formats (print/digital).	4.78	Very Effective
Visuals and design elements enhance understanding.	4.91	Very Effective
The module accommodates different learning styles.	4.65	Very Effective
AWM	**4.79**	Very Effective
F. Gender and Development (GAD) Sensitivity	**WM**	**VI**
The module uses gender-fair and inclusive language.	4.91	Very Effective
The examples and illustrations reflect gender equality.	4.91	Very Effective
The module avoids gender stereotypes in teaching contexts.	4.78	Very Effective
The content promotes respect for diversity and inclusivity.	4.96	Very Effective
The module prepares me to apply gender-sensitive teaching practices in the classroom.	4.83	Very Effective
AWM	**4.88**	Very Effective

Average Percentage Scores of students for each topic in the Self-Paced Learning Module in Statistics and Probability

The Average Percentage Scores (APS) reveal that students generally achieved very high levels of mastery across the majority of topics included in the Self-Paced Learning Module. Scores ranged from 59.93% to 100%, indicating varying levels of difficulty among the instructional topics but an overall satisfactory learning outcome. Several foundational concepts, namely History of Statistics, Definition and Importance of Statistics, Branches of Statistics, Sources of Data, Variables and Constants, Textual, Tabular and Graphical Form, and Skewness and Kurtosis, obtained a perfect Average Percentage Score of 100%, indicating complete mastery of these lessons by the students. These findings suggest that the instructional content was clearly presented, appropriately sequenced, and effectively facilitated understanding of basic statistical concepts. Students were able to acquire essential knowledge that serves as the foundation for more complex statistical procedures. Likewise, high mastery was observed in topics such as Scales of Measurement (98.91%), Sampling Methods (97.27%), Frequency Distribution Tables (95.88%), Mean (98.61%), Median (98.26%), Probability (94.78%), Chi-square Test (97.73%),

and Permutation (87.25%), indicating that the module effectively supported students in learning computational and analytical statistical concepts. However, one notable finding is the relatively lower performance in Measures of Dispersion, which recorded the lowest Average Percentage Score of 59.93%. This suggests that students experienced greater difficulty in understanding concepts involving variance, standard deviation, and other measures of variability. Parallel to the claim of Plancencia Ibadango, and colleagues (2025), there are conceptual gaps in learning probability and statistics, particularly in handling measures of dispersion, which are not limited to knowledge by incomplete reason patterns. This competency of variability reasoning is being used by students with higher statistical literacy, as revealed by the study of Setiawan and Sukoco (2021). Similarly, lower scores were observed in Correlation Test (80.87%), Population and Sample (84.13%), Standard Score and Normal Curve (85.59%), and Mode (86.96%). These topics typically require greater conceptual understanding and mathematical reasoning, indicating areas where supplementary instructional activities or additional examples may further improve learning. Overall, the results indicate that the Self-Paced Learning Module successfully facilitated mastery of most statistical concepts while identifying specific content areas requiring instructional enhancement.

Table 2. Average Percentage Scores of students for each topic in the Self-Paced Learning Module in Statistics and Probability

Topic Number	Topic	Average Percentage Score
1	History of Statistics	100.00%
2	Definition and Importance of Statistics	100.00%
3	Branches of Statistics	100.00%
4	Sources of Data	100.00%
5	Variable and Constant	100.00%
6	Scales of Measurement	98.91%
7	Population and Sample	84.13%
8	Sampling Methods and Techniques	97.27%
9	Stem-and-Leaf Diagram	95.43%
10	Textual, Tabular, and Graphical Form	100.00%
11	Frequency Distribution Table	95.88%
12	Frequency Polygons and Cumulative Frequency Graph	99.13%
13	Mean (Grouped and Ungrouped Data)	98.61%
14	Median (Grouped and Ungrouped Data)	98.26%
15	Mode (Grouped and Ungrouped Data)	86.96%
16	Quantiles (Quartiles, Deciles and Percentiles)	94.64%
17	Measures of Dispersion	59.93%
18	Standard Score, Normal Curve, Empirical Rule and Chebyshev's Theorem	85.59%
19	The Fundamental Counting Principle	96.87%
20	Summation Notation	89.57%
21	Factorial	95.22%
22	Permutation	87.25%
23	Combination	93.33%
24	Probability	94.78%
25	Skewness and Kurtosis	100.00%
26	Correlation Test	80.87%
27	Chi-square Test	97.73%

Academic Performance of Students after the Utilization of Self-Paced Learning Module (SLM) in Elementary Statistics and Probability

Table 3 shows the average grade of the students after the utilization of the self-paced learning module (SLM) in Elementary Statistics and Probability. The academic performance results reveal that students achieved an overall mean grade of 1.75, which is interpreted as Very Satisfactory. The highest recorded grade was 1.00 (Excellent), while the lowest was 2.25 (Satisfactory). These findings indicate that despite variations in individual performance, all students attained satisfactory academic achievement after utilizing the module. The absence of failing grades suggests that the Self-Paced Learning Module effectively supported students regardless of individual learning pace. Since self-paced learning allows learners to revisit lessons, complete activities independently, and study according to their own schedules, it provides opportunities for improved comprehension and retention of concepts. These findings imply that the module contributed positively to students' cognitive development and learning outcomes, particularly in Statistics and Probability. According to the findings of Torres (2022), there are several challenges that students encounter in the modular distance learning during the pandemic, such as a lack of interaction with teachers, especially since students would be the ones studying modules on their own with the help of available online resources. In this study, the difficulty discussed in the study of Torres is addressed since the self-paced learning module served as a tool of the teacher and not the primary learning modality since that the teacher still meets students in a face-to-face class.

Table 3. Academic Performance of Students after the Utilization of Self-Paced Learning Module (SLM) in Elementary Statistics and Probability

Statistical Measures	Grade	Interpretation
Mean	1.75	Very Satisfactory
Minimum	2.25	Satisfactory
Maximum	1.00	Excellent

Relationship between the Evaluation Given by the Students on the Utilized Self-Paced Learning Module in Elementary Statistics and Probability and their Academic Performance

Table 4 shows the significant indicators of the module characteristics on the academic performance of the students. Based on the result, the application of theoretical knowledge to practice as one of the characteristics of the SLM relates positively to the academic performance of the students. In addition, other characteristics of module such as encourages creativity in teaching approaches; alignment of assessments with the learning objectives; visual and design elements enhance understanding; and examples and illustrations reflect gender equality relate contribute positively on the academic performance of the students. The correlation analysis demonstrates that several characteristics of the Self-Paced Learning Module have significant positive relationships with students' academic performance. Among the evaluated characteristics, the strongest relationship was observed in the statement: "The activities help me apply theoretical knowledge to practice" $r = .469$; $p = .024$. This significant positive correlation indicates that students who perceived the module as effectively connecting theory with practice also tended to obtain higher academic performance. Practical application of concepts enhances conceptual understanding and enables students to transfer knowledge into authentic learning situations. Similarly, the statement: "The assessments align with the learning objectives" $r = .469$; $p = .024$ also demonstrated a statistically significant relationship with academic performance. This suggests that when assessment tasks directly reflect learning outcomes, students become better prepared to demonstrate their

knowledge and competencies. The module's ability to encourage creativity in teaching approaches likewise exhibited a significant relationship with academic achievement (r = .450, p = .031). This implies that learning activities requiring creativity and innovation may promote deeper understanding and stronger engagement among future mathematics teachers. Furthermore, visual design elements (r = .414, p = .049) significantly influenced academic performance. Effective graphics, diagrams, and visual representations likely reduced cognitive load and improved conceptual understanding. Interestingly, examples and illustrations reflecting gender equality also showed a significant relationship with students' academic performance (r = .414, p = .049). This finding suggests that inclusive instructional materials contribute to creating positive learning environments where students feel respected and represented, thereby supporting academic engagement. Since all reported p-values are below the 0.05 level of significance, the null hypothesis was rejected for all five module characteristics. Therefore, these instructional features significantly contribute to students' academic success. Overall, the results indicate that effective instructional design extends beyond content delivery; authentic learning activities, aligned assessments, meaningful visuals, creativity, and inclusive educational practices collectively enhance student achievement. The results are found in conformity with the claim of Yarnal, Griffiths, and Cheever (2023) that when inclusive conditions are created by teachers that feature the use of instructional supports for self-directed learning, students could achieve better.

Table 4. Relationship between the Evaluation Given by the Students on the Utilized Self-Paced Learning Module in Elementary Statistics and Probability and their Academic Performance.

Module Characteristics	r-value	p-value	Decision	Interpretation
The activities help me apply theoretical knowledge to practice.	.469*	0.024	Reject Ho	Significant
The module encourages creativity in teaching approaches.	.450*	0.031	Reject Ho	Significant
The assessments align with the learning objectives.	.469*	0.024	Reject Ho	Significant
Visuals and design elements enhance understanding.	.414*	0.049	Reject Ho	Significant
The examples and illustrations reflect gender equality.	.414*	0.049	Reject Ho	Significant

*Note: Highest Grades = 1.00; Lowest Grade = 5.00

Differences in the Characteristics of the Self-Paced Learning Module in Elementary Statistics and Probability based on the evaluation of the respondents

The Kruskal-Wallis test was conducted to determine whether significant differences exist among respondents' evaluations of the different characteristics of the Self-Paced Learning Module. The findings revealed: H = 4.72p = 0.45. Since the computed p-value (0.45) is greater than the 0.05 level of significance, the null hypothesis was not rejected, indicating no significant differences among respondents' evaluations of the module characteristics. This result implies that respondents consistently perceived all six dimensions of the module as equally effective. The obtained mean ratings further support this conclusion: Gender and Development (GAD) Sensitivity – 4.88; Content Quality and Relevance – 4.83; Assessment and Feedback – 4.83; Usability and Accessibility – 4.79; Instructional Design and Organization – 4.78; Learning Activities and Engagement – 4.75.

Although Gender and Development obtained the highest numerical mean, the statistical analysis indicates that this difference is not large enough

to be considered statistically significant. Therefore, every dimension contributed comparably to the overall effectiveness of the Self-Paced Learning Module. This consistency demonstrates that the module possesses balanced instructional quality, integrating strong content, effective pedagogy, learner engagement, valid assessment, accessibility, and inclusivity into one comprehensive instructional resource.

Taken together, the findings strongly indicate that the Self-Paced Learning Module in Elementary Statistics and Probability is an effective instructional intervention for future mathematics educators. Students demonstrated high mastery across most statistical topics, achieved an overall Very Satisfactory academic performance, and positively evaluated all aspects of the module. Moreover, several instructional characteristics—particularly the application of theoretical knowledge to practice, alignment of assessments with learning objectives, encouragement of creativity, use of effective visuals, and promotion of gender equality—were found to have statistically significant positive relationships with students' academic achievement. These findings underscore that high-quality instructional design can directly enhance learning outcomes. Finally, the absence of significant differences among the six evaluation dimensions suggests that the module maintains a balanced level of excellence across all instructional components. Consequently, the Self-Paced Learning Module may be considered a highly suitable instructional material for Statistics and Probability courses in teacher education programs and has strong potential for wider implementation in higher education institutions

Table 5. Differences in the Characteristics of the Self-Paced Learning Module in Elementary Statistics and Probability based on the evaluation of the respondents

Characteristics	Median	H-value	p-value	Decision	Interpretation
A. Content Quality and Relevance	5.00	4.72	0.45	Failed to Reject Ho	Not Significant
B. Instructional Design and Organization	4.80				
C. Learning Activities and Engagement	4.80				
D. Assessment and Feedback	5.00				
E. Usability and Accessibility	5.00				
F. Gender and Development (GAD) Sensitivity	5.00				

4. Discussion

The findings of the study provide strong empirical evidence that the Self-Paced Learning Module in Elementary Statistics and Probability is a highly effective instructional material for future mathematics educators. Students consistently evaluated the module as Very Effective across all dimensions, including content quality, instructional design, learning engagement, assessment and feedback, usability and accessibility, and Gender and Development sensitivity. These results indicate that the module possesses the essential characteristics of a high-quality instructional resource capable of supporting flexible, learner-centered, and inclusive education. The result is consistent with the findings of Etherington and colleagues (2026) that students are enthusiastically positive about numeracy modules, despite holding negative attitudes towards mathematics courses. In addition, Shirk (2020) proposed that there is a need to reflect and practice the alignment of different assessments in a course that the teacher taught or plans to teach. The high levels of mastery demonstrated across most statistical topics, together with the students' Very

Satisfactory academic performance, further confirm that the module effectively enhances conceptual understanding, procedural competence, and overall learning achievement in Elementary Statistics and Probability. Moreover, the significant positive relationships between selected module characteristics and academic performance demonstrate that authentic learning activities, constructive assessment, creative instructional approaches, effective visual design, and gender-responsive content contribute meaningfully to students' academic success. As found out by Dhakal (2023), digital pedagogy is essential for ensuring self-paced learning of mathematics. Since a soft copy of the complete set of modules was given to the students, they had an opportunity to browse the module during their free time using their electronic device, such as a laptop, tablet, or cellular phone. The study supports the claim of Quiano and Avila (2023) that the use of a module supports the students' ability to think creatively, logically, and critically, as well as process information, hence making it effective. Finally, the absence of significant differences in students' evaluations across the six instructional dimensions indicates that the module maintains a balanced standard of excellence throughout its design and implementation. Consequently, the Self-Paced Learning Module may be regarded as an effective, reliable, and pedagogically sound instructional innovation that supports independent learning while strengthening the professional competencies of future mathematics educators. Its demonstrated effectiveness suggests that it can be confidently adopted in teacher education institutions and may serve as a valuable model for the development of self-paced instructional materials in other mathematics and education courses. This connects to the findings of Akimov and colleagues (2024) that the utilization of learning materials provided by instructors continues to play a vital role for a successful outcome.

5. Conclusion

The study's results provide strong support for the effectiveness of the Self-Paced Learning Module in Teaching and Learning Elementary Statistics and Probability for future mathematics educators. It is likewise concluded that to make SLM effective, there should be activities that relate theoretical knowledge to practice; assessments that align with the learning objectives; visuals and designs that enhance understanding; and gender equality reflected.

6. References

Akimov, A., Malin, M., Sargsyan, Y., Suyunov, G., & Turdaliev, S. (2024). Student success in a university first-year statistics course: Do students' characteristics affect their academic performance?. Journal of Statistics and Data Science Education, 32(1), 24-35.

Bustoba, A. M., & Cruz, M. C. A. D. (2022). Development and validation of self-paced learning digital module in Mathematics 10. Polaris Global Journal of Scholarly Research and Trends, 1(1), 12-28.

CHED Memorandum Order No. 75 s 2017. Policies, Standards and Guidelines for Bachelor of Secondary Education (BSEd)

Bicoy, G., Matchon, N., Manon-og, M., Bocala, C., Tagalogon, L., & Bayadog, L. (2025). The Impact of Self-Paced Learning on Motivation and Focus in General Mathematics During the COVID-19 Pandemic. Journal of Education and Learning Reviews, 2(5), 107-120.

Cabral, C. S. (2023). Development and validation of instructional modules on CHED Mandated topics in mathematics in the modern world. Innovations, 72, 1393-1406.

Dhakal, B. P. (2023). Digital pedagogy for self-paced learning in mathematics education. Journal of Mathematics Education, 5(1), 1-14.

Etherington, S., Callan, N., Koh, S. H., Maker, G., Bennett, R., & Warburton, N. (2026). Bespoke, Relevant, and Inclusive Self-Paced, Online Modules to Build Tertiary Mathematics Engagement and Confidence. Education Sciences, 16(2), 203.

Hamzah, H., Hamzah, M. I., & Zulkifli, H. (2022). Systematic literature review on the elements of metacognition-based higher order thinking skills (HOTS) teaching and learning modules. Sustainability, 14(2), 813.

Kandeel, R. A. A. (2019). Students' academic difficulties in learning a statistics and probability course: The instructors' view. Journal of Education and Practice, 10(9), 43-52.

Kasih, A. C., & Siregar, T. J. (2024). Development of Mathematics Learning e-Modules to Improve Students' Mathematical Communication Skills. International Journal of Trends in Mathematics Education Research, 7(1), 59-65.

Makwakwa, E. G., Mogari, D., & Ogbonnaya, U. I. (2024). First-year undergraduate students' statistical problem-solving skills. Teaching Statistics, 46(1), 8-23.

Lessky, F., & Unger, M. (2023). Working long hours while studying: a higher risk for First-in-Family students and students of particular fields of study?. European Journal of Higher Education, 13(3), 347-366.

Placencia Ibadango, S. M., Tapia Yagual, N. K., Murillo Moscoso, J. R., & Salazar Morante, D. J. (2025). Common difficulties in learning probability and statistics among first-year mathematics students. Centro Sur, 9(4), 56–68. https://doi.org/10.37955/cs.v9i4.397

QUIANO, M., & Avila, E. B. (2023). The Use Of Modular Distance Learning In Relation To The Problem-Solving Skills In Statistics And Probability Of Grade 11 Students. International Journal of Business, Law, and Education, 4(1), 32-40.

Roman, A. G. (2016). Development and validation of statistics module for quality educational research. International Journal of Science and Research, 5(9), 104-108.

Roman, A. G. (2020). Instructional module (IM) in probability and statistics for mathematics major students: Apex, pitfall, and pilot. Asia Pacific Journal of Multidisciplinary Research, 8(3), 77-87.

Salvador, I. G., & Supan, A. (2022). Knowledge and attitude towards statistics and probability of senior high school students. Asia Pacific Journal of Educational Perspective.

Santillan, J. P. (2023). Development of three differentiated mathematics learning modules: A blended and scaffold-based learning materials for new normal remote learning. Journal of Agriculture and Technology Management (JATM), 26, 1.

Setiawan, E. P., & Sukoco, H. (2021). Exploring First Year University Students' Statistical Literacy: A Case on Describing and Visualizing Data. Journal on Mathematics Education, 12(3), 427-448.

Shirk, J. (2020). Designing a self-paced learning experience to support learner self-regulation. Journal of Teaching and Learning with Technology, 9(1).

Torres, M. A. (2022). Academically challenged students in mathematics in modular distance learning. International Journal of Current Science Research and Review, 6(06).

Yarnall, L., Griffiths, R., & Cheever, H. (2023). Teaching and Designing Online STEM Courses to Support Self-Directed Learning Skills. Grantee Submission.

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8. Author Declaration

This piece of work is original.

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