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Improving Statistical Literacy through Evidence-Based Strategies Among First-Year Education Students in a State University

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Abstract: Statistical literacy is crucial for cultivating well-rounded thinkers. The integration of evidence-based strategies in teaching and learning is pivotal for enhancing students' statistical literacy. This research specifically focuses on the utilization of Share and Model Concepts and Nurturing Metacognition as evidence-based strategies aimed at improving the statistical literacy of learners. The study employed a quasi-experimental design, specifically the nonequivalent control group, wherein students answered pre-test and post-test instruments and researcher-made questionnaires. The study included 50 first-year Bachelor in Secondary Education majors in Mathematics and Science for the academic year 2023–2024. The results of the study revealed a significant difference in the scores of student respondents, indicating that the use of evidence-based strategies helped students enhance their statistical literacy. This signifies a noteworthy increase in their performance, ranging from very low to very high proficiency in understanding statistical concepts, insights into the application of statistical concepts, numeracy, graph skills, interpretation capabilities, and visualization and communication skills. Furthermore, the study showed a significant difference in the post-test scores' performance of the two groups in understanding statistical concepts and visualization and communication skills. However, no significant difference was found in the post-test scores of the two groups concerning insights into the application of statistical concepts, numeracy and graph skills, and interpretation capabilities. Additionally, students acknowledged that the implementation of evidence-based strategies significantly contributed to the improvement of their statistical literacy.

Keywords: Statistical literacy; Evidence-based strategies; Share and model concepts; Nurturing metacognition; Quasi-experimental

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1. Introduction

In today's age, it is crucial for individuals not only to read reports but also to understand statistics, assess the values of data, and critically analyze and interpret them. This underscores the significance of statistical literacy, enabling individuals to discern true information. This skill set extends beyond academic contexts, permeating

everyday life, professional settings, and policy-making.

To meet the demands of 21st-century education, these skills are integrated into every level of statistical learning. Adapting to the needs of the 21st century, the incorporation of mathematical literacy into the educational curriculum at all levels ensures that individuals are not merely consumers but also informed interpreters of information that shapes their collective understanding.

A solid foundation in statistics equips individuals with the tools to navigate today's increasingly data-driven society. In an era marked by information overload and the spread of misleading statistics, individuals with strong statistical literacy skills are better equipped to distinguish fact from fiction, critically evaluate research findings, and actively participate in public discourse. Furthermore, statistical literacy plays a pivotal role in education by enabling students to develop quantitative reasoning abilities essential for success in an increasingly data-centric workforce.

In line with this, statistical literacy, defined as the ability to interpret, understand, and critically evaluate data, has emerged as an indispensable skill in today's data-driven society [1-4]. With the spread of information through digital media and the increasing reliance on data-driven decision-making across diverse fields, the need for statistical literacy has never been more pressing. Similarly, statistical literacy has outlined the operational and essential competencies necessary to improve statistical understanding, including understanding statistical concepts, insight into the application of statistical concepts, numeracy skills, making graphics, interpretation skills, and visualization and communication skills [5].

Moreover, statistical literacy is imperative for educators to think and apply teaching pedagogy to enhance and improve students' performance. It empowers individuals to navigate the overflow of data, make informed judgments, and engage in evidence-based decision-making. Strategies, activities, and programs are effective when based on evidence. It is crucial that teachers adopt effective evidence-based practices to support student achievement and reduce achievement gaps. Despite students having knowledge of the information needed to teach, a significant number lack adequate guidance in implementing evidence-based practices in teaching that information. Although the early status of the implementation of strategies was recognized as high, some students were weak in certain areas of the mathematics curriculum [6]. This reveals that the methods and strategies of teaching by teachers significantly affect the implementation status of the curriculum.

This research investigated the past state of statistical literacy, shedding light on existing challenges and opportunities for improvement, with the ultimate goal of fostering a more statistically literate and informed society. It aimed to delve into the multifaceted aspects of statistical literacy, exploring its significance, measurement, and implications across different domains. With this, the researcher believed that the use of evidence-based strategies might help students enhance their understanding of statistical concepts. Furthermore, students might have been able to use their understanding in the real-life application of statistics, where they could form sound decisions.

2. Literature review

2.1. Statistical literacy

Statistical literacy can be acquired when students possess high initial knowledge, leading to good statistical performance [7,8]. This is characterized by eagerness in tasks, active participation during discussions, and proactive engagement. Conversely, students with low self-esteem tend to be less active and lack motivation to complete tasks [8,9]. Furthermore, knowledge and mathematical self-esteem play crucial roles in enhancing students' statistical literacy abilities.

Statistical literacy, defined as the ability to comprehend and interpret statistical information across diverse

platforms, including graphs, tables, statements, and descriptions [10,11], requires not only the interpretation of data through visual and textual representations but also a deeper understanding of the methods and assumptions behind statistical analysis. This skill empowers individuals to validate statistical inferences, fostering a critical approach to information in a data-saturated age that aims to facilitate meaningful discourse on complex issues.

Additionally, statistical literacy enables individuals to recognize the real-world relevance of mathematics, make informed judgments, and apply statistical knowledge in practical scenarios [7,8]. Despite the increasing demand for students to possess statistical literacy in the technology-driven era, many students in developing countries still face challenges with statistics. Statistics serves as both a problem-solving tool and a means of advancing scientific knowledge. Without statistical literacy, individuals may struggle to distinguish between reliable and unreliable information, leading to difficulties in interpreting, critically assessing, and conveying reactions to messages [2,12,13].

2.2. Evidence-based strategies

Despite the various approaches and strategies employed in teaching and learning mathematics, encountering low performance is unavoidable. This inevitably leads to difficulties in understanding the lessons and achieving success [14,15]. In a quasi-experimental design study, differentiated instruction is determined to be an effective way to address learning gaps in this subject. Specifically, it improved students' performance in mathematics even within a short period and increased their confidence in solving mathematical concepts [16].

Moreover, with the use of strategies, a quasi-experimental study [17], introduced an Online Process-Oriented Guided Inquiry Learning (POGIL) environment aimed at developing the critical thinking of students in mathematics. This innovation encouraged active participation and improved learning. Furthermore, these and other teaching strategies and innovations were proven to uplift the knowledge and performance of students in mathematics. With knowledge of goals and guidelines in forming numeracy strategies, it should be noted that having an in-depth understanding of these skills is necessary for higher math concepts. Additionally, tutorials, reassessing activities with low scores, providing supplementary materials, and remedial classes are recommended [18-20].

Metacognition holds significance in both learning and life encounters [21]. Beyond academic knowledge, as students develop an understanding of their cognitive processes, they initiate a response to significant questions and reflect on things to understand other people's perspectives. In this way, metacognition is a catalyst for individual growth, enhancing learning journeys and broader social encounters. In contrast, while the proper application of Evidence-Based Practices (EBP) enhances the probability of enhanced performance, there will generally be a minor proportion of students who do not exhibit a positive response. Hence, it is advisable for educators to gather data on the individual responses of each student to assess the effectiveness of the practice or program for each student [22].

In the same vein, nurturing the growth of metacognitive skills isn't solely about posing questions. Instead, it involves posing questions that prompt individuals to reflect on their thoughts and learning strategies within their field and explore how they can adjust them for various situations [23]. This form of reflection empowers students to determine the effectiveness of their cognitive tools and adapt them to different situations. Essentially, developing metacognitive skills involves not only asking questions but also cultivating the mindset of self-examination and self-modification for ongoing cognitive development.

This literature review emphasizes the interconnected role of literacy assessment processes, providing valuable formative assessment for students as they experience learning in a supportive, collaborative, and engaging way. Hence, when integrated into the statistics lesson, these processes offer holistic learning

experiences for students. The literature review emphasizes the interconnected role of pedagogies in teaching and enhancing literacy in Statistics among students. By integrating Statistical literacy processes into the classroom, teachers create a supportive and collaborative environment that enhances the student learning experience. This overview emphasizes the critical role of evidence-based strategies in a holistic approach that goes beyond instruction to develop literacy in statistics as well.

3. Research objectives and hypothesis

This study attempted to determine the effect of evidence-based strategies on the Statistical Literacy of first-year education students at One State University.

Specifically, the study is geared towards answering the following objectives.

(1) Determine the pre-test and post-test scores-performance of pre-service teachers' Statistics literacy in terms of:
   - Understanding statistics concepts;
   - Insight into the application of statistical concepts;
   - Numeracy skills and making graphics;
   - Interpretation skills;
   - Visualization and communication skills.

(2) Test the difference between the pre-test and post-test scores of two groups of respondents.

(3) Test the difference in the post-test scores of two groups of respondents.

(4) Assess the perception of the learners in the implementation of the evidence-based strategy in statistical literacy as to:
   - Understanding statistics concepts;
   - Insight into the application of statistical concepts;
   - Numeracy skills and making graphics;
   - Interpretation skills
   - Visualization and communication skills.

The hypotheses of this research were as follows:

(1) There is no significant difference between the pre-test and post-test scores performance of each group.

(2) There is no significant difference in the post-test scores performance of each group.

4. Research methods

4.1. Research design

This study adopted a quasi-experimental research design, specifically the nonequivalent group for two groups, to assess two strategies under evidence-based strategies. This research design involved the manipulation of a certain variable or the use of varied teaching strategies to identify significant differences in terms of skills development. Quasi-experimental design identified comparisons among groups that were similar to the treatment group in terms of characteristics [24]. The group being compared captured the results based on the implementation. Thus, in this design, it was not possible to randomize individuals or groups into treatment and control groups. Therefore, this research focused on the enhancement of statistical literacy through the use of evidence-based strategies, namely Share and Model Concepts (SMC) and Nurturing Metacognition (NM).

4.2. Respondents of the study

In line with this, the respondents of this research consisted of 25 students from two heterogeneously grouped classes of the first year Bachelor in Secondary Education major in Mathematics and Science for Share and Model Concepts and Nurturing Metacognition, respectively, at the College of Teacher Education of Laguna State Polytechnic University San Pablo City Campus for the first semester of the academic year 2023–2024. Hence, cluster sampling was employed. Cluster sampling, specifically non-equivalent cluster sampling, was a probability sampling technique where the subjects were chosen based on their sections' availability. The cluster of the researcher in terms of data gathering and administering the researcher also took into consideration. Cluster sampling is the most common type of sampling technique as it gives low and high sets of groups, which then makes them comparable with all other variables remaining the same. **Table 1** presents the respondents of the study in each group.

Table 1. Respondents of the study

Group	*n*	Respondents	Blind participants
Share and model concepts	31	25	6
Nurturing metacognition	25	25	0
Total	56	50	6

4.3. Research instrument

To measure the statistical literacy of the respondents, the study used a researcher-made instrument for both the pre-test and post-test. The instrument consisted of questions related to data management, specifically measures of central tendency, dispersion, position, correlation, and regression analysis. Additionally, to understand the respondents' perception of the implementation of the strategies, a researcher-made five-point Likert scale was formulated. This scale assessed the respondents' understanding of Statistics concepts, insights into the application of statistical concepts, numeracy skills and making graphics, interpretation skills, and visualization and communication skills, following the framework established [5].

4.4. Data gathering procedures

Before the conduct of this study, the researcher sought permission from the Dean of the college to conduct the study. In seeking permission, the instruments were validated by five experts. After the validation and obtaining permissions, the researcher administered a pre-test to two groups.

Further, the implementation of strategies for both groups lasted for 6 weeks. During each lesson discussion, the researcher allowed the students to perform tasks relevant to their current understanding. Students were exposed to two different strategies aligned with the evidence-based strategies. Since the school had a blended learning modality, there were two meetings per week, comprising one face-to-face and one synchronous online meeting. In each meeting, whether online or face-to-face, respondents were exposed to the use of strategies.

In the same vein, after students were exposed to the strategies, post-tests were administered. In addition to the administration of the post-test, the respondents answered the five-point Likert scale instrument and indicated their agreement with the implementation of the strategies.

4.5. Data analysis

In identifying the respondents' pre-test and post-test scores performance, the study used frequency, percentage, and count. Descriptive statistics, including mean and standard deviation, were employed to analyze respondents'

perceptions of the implementation of evidence-based strategies.

Moreover, in determining the differences, the researcher first assessed the normality of the data to choose appropriate parametric measures and found that the data were normal. Hence, to measure the difference in the pre-test and post-test scores of each group of respondents, an independent *t*-test was used.

Likewise, a paired *t*-test was employed to determine the difference in the post-test scores between the two groups. Thus, to assess the effect size of the two groups, Cohen's D was employed.

4.6. Ethical considerations

This study adhered to various ethical considerations. As a researcher, this set of principles had to be constantly considered when collecting data from people, especially the students involved in this study. Upon the completion of the research proposal, the researcher sought permission from the dean of the college. Subsequently, the student respondents were informed about the study.

The ethical considerations employed in this study were as follows: there was voluntary participation from first-year BSED Science and Mathematics students. Their identification was hidden through anonymity. The responses of the students remained confidential and were only used for this study. The researcher refrained from any form of plagiarism. Lastly, the students were informed about the results of this study.

5. Results and discussion

This focuses on the discussions and interpretation of data analyzed on evidence-based strategies and statistical literacy. This is to assess the performance of the learners in statistics with the implementation of evidence-based strategies: Share and Model Concepts and Nurturing Metacognition. This section presents the actual results, analysis of data, and interpretation concerning the comparison of the scores of the learners and their perception of the implementation.

Table 2 presents the pre-test and post-test scores of students on understanding statistical concepts. It is seen that before using Share and Model Concepts and Nurturing Metacognition in two groups, 52% of students in both groups had low performance on the pre-test. Hence, after the students were exposed to Share and Model Concepts, 84% achieved very high performance. Similarly, 96% of students exposed to Nurturing Metacognition achieved very high scores. It supports the idea that these educational strategies helped students develop understanding [25]. It implies that during the pre-test, students had difficulty calculating statistical concepts. Furthermore, the post-test revealed students' understanding of statistical concepts through their calculations.

Table 2. Pre-test and post-test scores of respondents' statistical literacy as to understanding statistical concepts

Scores	Share and model concepts				Nurturing metacognition				Interpretation
	Pre-test		Post-test		Pre-test		Post-test		
	f	%	f	%	f	%	f	%	
9-10	-	-	21	84	-	-	24	96	Very High
7-8	3	12	4	14	2	8	1	4	High
5-6	6	24	-	-	6	24	-	-	Average
3-4	13	52	-	-	13	52	-	-	Low
0-2	3	12	-	-	4	16	-	-	Very Low
Total	25	100	25	100	25	100	25	100	

Table 3 presents the scores of respondents as to pre-test and post-test on insights into the application of statistical concepts. As shown in the table, it is evident that before using Share and Model Concepts, 44% of students obtained low performance. Likewise, 32% of students in the Nurturing Metacognition group performed poorly on their pre-test. Moreover, after the students were exposed to Share and Model Concepts, 48% of the students achieved high and very high performance on the post-test, while 48% of students exposed to Nurturing Metacognition achieved very high scores on the post-test. It implies that during the pre-test, students had difficulty understanding and applying statistical concepts. Insights into how statistics are used in different fields prompt students to think critically and analyze concepts. Individuals tend to think critically about how a concept is to be used in day-to-day situations [26]. Furthermore, the post-test revealed students' understanding of statistical concepts through their calculations.

Table 3. Pre-test and post-test scores of pre-service teachers' statistics literacy as to insights into the application of statistical concepts

Scores	Share and model concepts				Nurturing metacognition				Interpretation
	Pre-test		Post-test		Pre-test		Post-test		
	f	%	f	%	f	%	f	%	
9-10	-	-	12	48	-	-	12	48	Very High
7-8	2	8	12	48	5	20	11	44	High
5-6	6	24	1	4	8	32	2	8	Average
3-4	11	44	-	-	8	32	-	-	Low
0-2	6	24	-	-	4	16	-	-	Very Low
Total	25	100	25	100	25	100	25	100	

Table 4 presents the scores of respondents as to pre-test and post-test on numeracy and graph skills. The table revealed that 44% and 40% of students under the Share and Model Concepts and Nurturing Metacognition groups, respectively, had very low performance. This indicates that students had difficulty understanding graphs and solving statistical concepts. On the other hand, 48% of students exposed to Share and Model Concepts strategies showed very high performance. In addition, 52% of the students in the Nurturing Metacognition group also showed high performance after exposure to that strategy. This depicts that the majority of the students, after exposure to the two strategies, improved their numeracy and graph skills. However, it revealed that even though evidence-based strategies and practices enhance performance [22], there are still students who are not able to exhibit a positive response, and more so, a correct response.

Table 4. Pre-test and post-test scores of pre-service teachers' statistics literacy as to numeracy and graph skills

Scores	Share and model concepts				Nurturing metacognition				Interpretation
	Pre-test		Post-test		Pre-test		Post-test		
	f	%	f	%	f	%	f	%	
9-10	-	-	12	48	-	-	11	44	Very High
7-8	-	-	11	44	3	12	13	52	High
5-6	7	28	1	4	8	32	1	4	Average
3-4	7	28	1	4	4	16	-	-	Low
0-2	11	44	-	-	10	40	-	-	Very Low
Total	25	100	25	100	25	100	25	100	

Table 5 presents the pre-test and post-test scores of respondents on interpretation capabilities. It can be seen in the table that 48% of the students in the Share and Model Concepts group had low performance in interpreting statistical concepts, while 36% of the students in the Nurturing Metacognition group performed at an average level in interpreting statistical concepts. On the other hand, after being exposed to evidence-based strategies, there is a significant increase in the students' scores. A total of 60% of the students exposed to Share and Model Concepts exhibited high performance, while 56% of the students exposed to Nurturing Metacognition demonstrated very high performance. Furthermore, this emphasizes that the use of strategies helped students perform well in interpreting statistical concepts. A particular capability of an individual, especially in interpretation, may be developed through certain instructional strategies [27]. Thus, this is also relative to decision-making, where interpretation plays an integral part. It is evident when students can express their understanding by giving their interpretations and implications of the concept.

Table 5. Pre-test and post-test scores of pre-service teachers' statistics literacy as to interpretation capabilities

Scores	Share and model concepts				Nurturing metacognition				Interpretation
	Pre-test		Post-test		Pre-test		Post-test		
	f	%	f	%	f	%	f	%	
9-10	-	-	10	40	1	4	14	56	Very High
7-8	2	8	15	60	8	32	11	44	High
5-6	5	20	-	-	9	36	-	-	Average
3-4	12	48	-	-	5	20	-	-	Low
0-2	6	24	-	-	2	8	-	-	Very Low
Total	25	100	25	100	25	100	25	100	

Table 6 presents the scores of respondents as to pre-test and post-test on visualization and communication skills. It can be seen that 48% and 60% of the students who underwent Share and Model Concepts and Nurturing Metacognition, respectively, had very low performance. Students had difficulty in visualizing and communicating statistical concepts. Additionally, the majority of the students, after being exposed to evidence-based strategies, improved their visualization and communication skills. A total of 64% and 56% of the students exposed to Share and Model Concepts and Nurturing Metacognition, respectively, demonstrated high performance in visualizing and communicating statistical concepts.

Table 6. Pre-test and post-test scores of pre-service teachers' statistics literacy as to visualization and communication skills

Scores	Share and model concepts				Nurturing metacognition				Interpretation
	Pre-test		Post-test		Pre-test		Post-test		
	f	%	f	%	f	%	f	%	
9-10	-	-	1	4	-	-	7	28	Very High
7-8	1	4	16	64	2	8	14	56	High
5-6	6	24	8	32	4	16	4	16	Average
3-4	12	48	-	-	15	60	-	-	Low
0-2	6	24	-	-	4	16	-	-	Very Low
Total	25	100	25	100	25	100	25	100	

Table 7 presents the significant difference in the performance scores of respondents exposed to the Share and Model Concepts strategy. The table shows that scores significantly increased after students were exposed to the evidence-based strategy of Share and Model Concepts. This revealed a difference in the score performance of students exposed to the Share and Model Concepts strategy, supporting that pre-test scores, where most students in this group had low performance, differed from the very high performance on the post-test.

It signifies that learners exposed to this strategy were able to solve statistical questions, provide more insights into the statistical concepts used in each problem, interpret the results, understand graphical representations, and even visualize and communicate statistical concepts to others. Thus, it proves that the use of Share and Model Concepts as an evidence-based strategy significantly affected students' statistical literacy. This is supported by a study, through a certain strategy, that improved the performance of the students even if it was conducted in a short period and increased their confidence in solving mathematical concepts [16].

Table 7. Test of difference on the pre-test and the post-test scores of the respondents exposed in evidence-based strategies in terms of Share and Model Concepts

Statistical literacy	Test	Mean	SD	Paired differences		*t*	Sig.
				Mean	SD		
Understanding statistical concepts	Pre-test	4.12	1.72	5.04	1.74	14.453**	0.000
	Post-test	9.16	0.80				
Insights into the application of statistical concepts	Pre-test	3.80	1.78	4.40	1.91	11.489**	0.000
	Post-test	8.20	0.91				
Numeracy and graph skills	Pre-test	3.20	1.68	4.88	1.39	17.503**	0.000
	Post-test	8.08	1.29				
Interpretation capabilities	Pre-test	3.84	2.03	4.56	2.14	10.642**	0.000
	Post-test	8.40	0.96				
Visualization and communication skills	Pre-test	3.64	1.70	3.40	1.71	9.954**	0.000
	Post-test	7.92	1.15				

**Significant at 0.01 level

Table 8 shows the significant difference in performance scores between the pre-test and post-test of respondents exposed to the Nurturing Metacognition strategy. The table shows that scores significantly increased after students were exposed to the evidence-based strategy of Nurturing Metacognition. This demonstrates a significant difference in the scores of students, supporting that pre-test scores, where most students from this group had low performance, differed from the very high performance on the post-test.

It signifies that the learners exposed to this strategy were able to solve statistical problems, provide more insights by asking questions and clarifying things in their minds regarding the statistical concepts used in each problem, interpret the results, understand graphical representations, and even visualize and communicate statistical concepts to others. It proves that the use of Nurturing Metacognition as an evidence-based strategy has significantly affected students' statistical literacy.

Metacognition is important not only in academic settings but also in real-life experiences. Individuals, as they gain insights into their thought processes, naturally start pondering important questions and delve into reflections to comprehend the perspectives of others [21]. It represents a broader aspect that goes beyond just

academic knowledge and extends to how individuals navigate and understand the world around them. This is evident when students in that group ask questions, paving the way for a better understanding of the lesson, the concept, and the statistics itself.

Table 8. Test of difference on the pre-test and the post-test scores performance of the respondents exposed in evidence-based strategies in terms of Nurturing Metacognition

Statistical literacy	Test	Mean	SD	Paired differences		*t*	Sig.
				Mean	SD		
Understanding statistical concepts	Pre-test	4.04	1.51	5.56	1.76	15.815**	0.000
	Post-test	9.60	0.71				
Insights into the application of statistical concepts	Pre-test	4.68	2.04	3.60	2.25	7.984**	0.000
	Post-test	8.28	1.21				
Numeracy and graph skills	Pre-test	3.60	2.16	4.64	2.10	11.052**	0.000
	Post-test	8.24	1.42				
Interpretation capabilities	Pre-test	5.48	1.92	2.96	1.95	7.602**	0.000
	Post-test	8.44	0.92				
Visualization and communication skills	Pre-test	3.68	1.70	4.24	1.90	11.163**	0.000
	Post-test	7.92	1.15				

**Significant at 0.01 level

Table 9 presents the significant difference in the scores performance as to pre-test and post-test of respondents exposed to the Share and Model Concepts and Nurturing Metacognition. The data indicates a difference between the two strategies concerning the understanding of statistical concepts and visualization and communication skills. While it is evident that both strategies improved students' performance, distinctions exist between Share and Model Concepts and Nurturing Metacognition. In understanding statistical concepts and visualization and communication skills, students exposed to Nurturing Metacognition demonstrated higher performance than those exposed to the Share and Model Concepts strategy. This suggests that Nurturing Metacognition played a significant role in enhancing the understanding of statistical concepts and visualization and communication skills.

However, no significant difference in post-test scores performance was observed in insights into the application of statistical concepts, numeracy, graph skills, and interpretation capabilities. This implies that either Share and Model Concepts or Nurturing Metacognition may be used as a strategy to enhance statistical literacy.

Nurturing the growth of metacognitive skills isn't solely about posing questions. Instead, it involves posing questions that prompt individuals to reflect on their thoughts and learning strategies within their field and explore how they can adjust them for various situations [23]. Although the two strategies differ in approach, it is evident and observed that both strategies helped enhance and improve students' statistical literacy.

Table 9. Test of difference on the post-test scores performance of the respondents exposed to Share and Model Concepts and Nurturing Metacognition

Statistical literacy	Group	Mean	SD	*t*	Sig.	Mean diff.	Cohen's D
Understanding statistical concepts	SMC	9.16	0.80	2.060*	0.048	0.44	0.58 (Medium)
	NM	9.60	0.71				
Insights into the application of statistical concepts	SMC	8.20	0.91	0.264	0.793	0.08	0.07 (Very small)
	NM	8.28	1.21				
Numeracy and graph skills	SMC	8.08	1.29	0.417	0.679	0.16	0.12 (Very small)
	NM	8.24	1.42				
Interpretation capabilities	SMC	8.40	0.96	0.151	0.881	0.04	0.01 (Very small)
	NM	8.44	0.92				
Visualization and communication skills	SMC	7.04	0.89	3.024**	0.004	0.88	0.86 (Large)
	NM	7.92	1.15				

df = 24; **Significant at 0.01 level; Cohen's D: 0.01–0.19 Very small; 0.20–0.49 Small; 0.50–0.79 Medium; 0.80–1.19 Large; 1.20–1.99 Very large; > 2.0 Huge

Table 10 shows the assessment of respondents on the implementation of the Share and Model Concepts. The table indicates that students exposed to Share and Model Concepts strongly agreed that they are able to interpret statistical concepts. After being exposed to the strategy, their capabilities in interpreting statistical concepts were enhanced. They could interpret the results in measures of central tendency, dispersion, relative positions, normal distribution, correlation, and linear regression.

On the other hand, students agreed that there is development in understanding statistics concepts, insights into the application of statistical concepts, numeracy and graph skills, and visualization and communication skills. Students showed agreement on the improvement of statistical literacies as reflected in the enhancement of post-test scores performance. Furthermore, the group of students exposed to Share and Model Concepts agreed that the implementation of evidence-based strategy helped them enhance their statistical literacy.

Table 10. Assessment of respondents on the implementation of Share and Model Concepts strategy

Statistical literacy	Mean	SD	Verbal interpretation
Understanding statistical concepts	4.19	0.30	Agree
Insights into the application of statistical concepts	4.14	0.46	Agree
Numeracy and graph skills	3.92	0.30	Agree
Interpretation capabilities	4.25	0.94	Strongly agree
Visualization and communication skills	4.06	0.46	Agree
Overall	4.19	0.30	Agree

Table 11 shows the assessment of respondents on the implementation of the Nurturing Metacognition. As gleaned from the table, the group of students exposed to Nurturing Metacognition strongly agreed that they enhanced their understanding of statistical concepts, insights into the application of statistical concepts, and visualization and communication skills. After being exposed to the strategy, students were able to comprehend how to compute statistical concepts such as measures of central tendency, dispersion, relative position, normal distribution, correlation, and linear regression. Their insights into the concepts were evident, leading to

improved visualization and communication skills.

Moreover, students agreed on the enhancement of their numeracy and graph skills as well as interpretation capabilities. After exposure to the strategy, there was an enhancement and development in their interpretation skills. As reflected in the post-test scores performance of this group of respondents, it is evident that their interpretation skills and capabilities were notable. Students were able to interpret the results of the computations and the graph of statistical concepts.

Table 11. Assessment of respondents on the implementation of Nurturing Metacognition strategy

Statistical literacy	Mean	SD	Verbal interpretation
Understanding statistical concepts	4.30	0.42	Strongly agree
Insights into the application of statistical concepts	4.52	0.34	Strongly agree
Numeracy and graph skills	4.04	0.48	Agree
Interpretation capabilities	4.13	0.55	Agree
Visualization and communication skills	4.36	0.37	Strongly agree
Overall	4.27	0.43	Strongly agree

6. Conclusions

In conclusion, this study revealed that there was a significant difference between the pre-test and post-test scores performance of those exposed to the use of Share and Model Concepts and Nurturing Metacognition. Therefore, there was enough statistical evidence to reject the hypothesis. Similarly, the post-test scores of students exposed to the use of Share and Model Concepts and Nurturing Metacognition on understanding Statistics concepts, and visualization and communication skills were significantly different. Therefore, the hypothesis was rejected. However, the study revealed that the post-test scores performance of the two groups on insights into the application of statistical concepts, numeracy and graph skills, as well as interpretation capabilities were not significantly different. Therefore, there was not enough statistical evidence to reject the hypothesis.

7. Recommendation

The study revealed that the use of Share and Model Concepts and Nurturing Metacognition enhanced the statistical literacy of the students, so mathematics teachers are encouraged to integrate these strategies into their instruction, especially in an online distance or face-to-face learning modality. Teachers may also use these tools not just for first-year college students but also for students in other year levels. Moreover, teachers of different areas of discipline may also adopt these strategies since evidence-based pedagogy is holistic in education. In addition, since the study was limited in its conduct to non-equivalent groups, the researcher suggests exploring the use of evidence-based strategies considering matched pairing of students before the conduct of the study. This is to identify which of the two strategies is more efficient in establishing the problem-solving skills of the students. Furthermore, future researchers may use this study as a reference for their research. Since the strategies were implemented in a blended learning modality, teachers are encouraged to conduct similar studies in pure face-to-face or online learning modalities in other subjects as well.

Disclosure statement

The author declares no conflict of interest.

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