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Analyzing Confidence Rate Index Based on Science Literacy Skills Through Science Teaching Approaches

Christian Mier Calampiano Escriba
Laguna State Polytechnic University Sta. Cruz Laguna 4009 PHILIPPINES
Email address: julierosemendoza002@gmail.com

***Abstract*—** *This study analyzed the confidence rate index based on science literacy skills through utilizing science teaching approaches of the first-year Bachelor of Secondary Education students major in Science at Laguna University College of Education. The purpose of this study was to assess how extensively scientific teaching methods are used with students. It also aimed to determine the level of their science literacy and the confidence rate index. This study was intended to find the significant relationship of science teaching approaches to the level of science literacy skills and its significant effect on confidence rate index (CRI). In this study, correlational research design was employed. Wherein, the forty (40) Bachelor of Secondary Education major Science students served as the participants. The researcher utilized a self-made and validated 4-point Likert Scale questionnaire for determining the level of science teaching approaches and test of science literacy skills and confidence rate index. The mean scores from gathered data were then organized and analyzed. Pearson product-moment correlation was used to determine the significant relationship between science teaching approaches and science literacy skills and Regression analysis to determine the significant effect of employing science teaching approaches and confidence rate index. The study found that all science teaching approaches received a very high level. While in terms of their level of science literacy, the respondents got the highest level of satisfaction in terms of the Functional level, with the procedural level as the lowest. With regards to the confidence rate index, an overall rating of very satisfactory was given. Results also showed that employing science teaching approaches had a significant relationship to students' literacy skills and on the other hand, it did not have a significant effect to their confidence rate index. This study concluded that science teaching approaches had a significant relationship to science literacy skills, thus, this led to the rejection of the null hypothesis. While, it was also found out that science teaching approaches had no significant effect on the confidence rate index which led to the acceptance of the null hypothesis. These results employed that various science teaching approaches affects the level of science literacy skills of the students, but they do not collectively influence their confidence rate index. With these findings, the utilization of collaborative and inquiry-based approaches may be beneficial to college instructors to uplift the procedural level of their students. Also, colleges and programs may provide teachers and students with pedagogical techniques to enhance science literacy skills.*

I. INTRODUCTION

In the 21st century, teaching science in all level is an important milestone in molding individuals in exploring the world which is increasing its influence in terms scientific advancements and technological innovations. In pursuit of the colleges and universities offering Bachelor in Secondary Education major in science to produce quality science teachers, their students are trained to be not only knowledgeable on the discipline but also, they must develop various skills need in the teaching process.

One of those skills which is very essential is the Science Literacy skills. Based on According to She et al. (2019), scientific literacy encompasses the comprehension and knowledge of scientific processes and concepts. It is also the ability of an individual to identify questions and draw conclusions based on evidences and scientific data. Students will find it easier to solve real-world issues in both the present times and the future if they have a concrete comprehension of science literacy (Anderson et al., 2020). Science literacy skills aid individual to understand and critically evaluate scientific information not only for academic success but also for making sound and informed decisions in everyday life. For this to happen, effective teaching approaches are needed to enhance not only the scientific knowledge of the students but also their scientific literacy.

Active learning approaches, technology-enhanced teaching, and culturally responsive pedagogy have emerged as revolutionary instruments in scientific education. These approaches focus on student engagement, hands-on learning, and the application of scientific concepts, allowing students to gain not only topic knowledge but also higher-order thinking skills.

Confidence rate index, in the context of answering exams or tests, pertains to the degree of confidence of the students about their answers. This concept can be utilized in educational assessments to measure not only the correctness of the answers, but also how well they know that their answers are correct based on their knowledge and understanding.
This study entitled "Analyzing Confidence Rate Index Based on Science Literacy Skills Through Science Teaching Approaches" aims to analyze the level of Confidence rate index of students based on their science literacy skills. By analyzing these relationships, the research aims to provide insights into how innovative teaching methods can improve both science literacy and confidence, ultimately fostering a generation of scientifically literate individuals equipped to thrive in a complex, science-driven world.

1.1 Statement of the Problem

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Problem/s which were addressed by the research

The study entitled "Analyzing Confidence Rate Index Based on Science Literacy Skills Through Science Teaching Approaches" specifically aims to answer the following questions:

1. What is the level of science teaching approaches of the students in terms of:
   1.1 Inquiry-based learning;
   1.2 Constructivist learning;
   1.3 Collaborative learning; and
   1.4 Problem-based learning?
2. What is the level of the Science Literacy Skills of the students in terms of:
   2.1 Procedural literacy level;
   2.2 Nominal literacy level;
   2.3 Functional literacy level; and
   2.4 Multidimensional literacy level?
3. What is the level of the Confidence Rate Index of the students based on the result of the scores of Science Literacy Skills?
4. Is there a significant relationship between the science teaching approaches and the science literacy of the students?
5. Is there a significant effect between the science teaching approaches and the Confidence Rate Index of the students?

II. Methodology

In this study, correlational research design was employed. Wherein, the forty (40) Bachelor of Secondary Education major Science students served as the participants. The researcher utilized a self-made and validated 4-point Likert Scale questionnaire for determining the level of science teaching approaches and test of science literacy skills and confidence rate index. The mean scores from gathered data were then organized and analyzed. Pearson product-moment correlation was used to determine the significant relationship between science teaching approaches and science literacy skills and Regression analysis to determine the significant effect of employing science teaching approaches and confidence rate index.

III. Results and Discussion

This part presented the different results and discussed the results from treating the data gathered in this study. All specific questions of the statement of the problem were answered in this chapter supported by tables. It presents the data gathered about the significant relationship between Science Teaching Approaches and Science Literacy Skills of the first year BSEd Students. In particular, the study sought to address the following:

Level of Science Teaching Approaches

In this study, the level of Science Teaching Approaches includes Inquiry-Based Learning, Constructivist Approach, Collaborative Learning, and Problem-based Learning.

The following tables show the statement, mean, standard deviation. Remarks and verbal interpretation from the perspectives of respondents.

TABLE 1. Level of Science Teaching Approaches in terms of Inquiry-Based Learning

Statements	Mean	SD	Remarks
Inquiry-based learning enhances my understanding of scientific concepts (e.g. Scientific investigations, guided inquiry, open-ended scientific questions, etc).	3.28	0.55	Strongly Agree
Participating in inquiry-based activities boosts my confidence in applying science skills.	3.13	0.79	Agree
My teacher encourages questions and investigations, which improves my science literacy.	3.48	0.68	Strongly Agree
Inquiry-based learning connects classroom concepts to real-world science applications.	3.38	0.59	Strongly Agree
Actively engaging with scientific concepts in inquiry-based learning deepens my comprehension.	3.30	0.69	Strongly Agree
Weighted Mean	3.31		
SD	0.67		
Verbal Interpretation	Very High		

Table 1 shows the level of science teaching approaches in terms of Inquiry-based learning as perceived by the first year BSED science students. With an overall weighted mean of 3.31 and standard deviation of 0.67 indicated a very high level of agreement regarding the effectiveness of Inquiry-based learning in the development of students' scientific engagement, comprehension and science literacy. This finding aligns with Wang et al. (2021), who found that inquiry-based approaches significantly enhance students' scientific performance and confidence in applying science concepts when paired with appropriate scaffolding techniques.

TABLE 2. Level of Science Teaching Approaches in terms of Constructivist Approach

Statements	Mean	SD	Remarks
The constructivist approach (e.g. concept mapping, hands-on experiments, reflective journals) supports me in building new knowledge based on past learning experiences.	3.55	0.68	Strongly Agree
Linking new scientific concepts to prior knowledge enhances my understanding.	3.53	0.51	Strongly Agree
Constructivist methods improve my critical thinking about scientific issues.	3.08	0.69	Agree
Active participation in learning through a constructivist approach strengthens my science literacy.	3.28	0.72	Strongly Agree
The constructivist teaching approach makes science more relevant to me.	3.23	0.58	Agree
Weighted Mean	3.33		
SD	0.66		
Verbal Interpretation	Very High		

Table 2 presented the students' perceptions on the Utilization of Constructivist Approach in teaching science. With an overall weighted mean of 3.33 and standard mean of 0.66, a remark of "Very High" indicating that there are high regards of students in the utility of Constructivist approaches in science teaching. These findings are supported by the findings of Williams and Otrel-Cass (2016), who emphasized that constructivist, ICT-enriched science inquiry methods significantly enhance students' engagement and conceptual understanding by connecting learning to their prior knowledge and real-world experiences.

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TABLE 3. Level of Science Teaching Approaches in terms of Collaborative Learning

Statements	Mean	SD	Remarks
Collaborative learning helps clarify complex scientific concepts (e.g. Jigsaw activities, group projects, peer teaching, etc.).	3.55	0.64	Strongly Agree
Group discussions and teamwork enhance my ability to explain scientific concepts.	3.45	0.68	Strongly Agree
Working in groups strengthens my problem-solving skills in science.	3.33	0.76	Strongly Agree
Collaborative activities improve my science communication and presentation skills.	3.58	0.55	Strongly Agree
Collaboration with peers increases my confidence in tackling scientific challenges.	3.40	0.67	Strongly Agree
Weighted Mean	3.46		
SD	0.66		
Verbal Interpretation	Very High		

Table 3 showed the level of the implementation of Collaborative learning in science teaching as perceived by the first year BSED science students. With an overall weighted mean of 3.46 and standard deviation of 0.66 the students' approval for the implementation of Collaborative learning is perceived as "Very High". These results are supported by the study of Liu et al. (2024), who noted that collaborative learning significantly enhances students' cognitive development, communication, and confidence in scientific contexts by promoting social interaction and co-construction of knowledge.

TABLE 4. Level of Science Teaching Approaches in terms of Problem-based Learning

Statements	Mean	SD	Remarks
Problem-based learning enables me to apply scientific concepts in real-world scenarios (e.g. real world case studies, scenario-based activities, hands-on projects)	3.25	0.63	Agree
Presenting real-life problems in class engages me in science learning.	3.60	0.59	Strongly Agree
Problem-solving activities develop my analytical and critical thinking skills in science.	3.35	0.62	Strongly Agree
Problem-based learning demonstrates the relevance of science in everyday life.	3.48	0.68	Strongly Agree
Solving classroom problems builds my confidence in science literacy skills.	3.15	0.66	Agree
Weighted Mean	3.37		
SD	0.65		
Verbal Interpretation	Very High		

Table 4 showed the level of science teaching approaches in terms of problem-based learning as perceived by the first year BSEd science students. With an overall weighted mean of 3.37 and standard deviation of 0.65, a remark of "Very High" was taken indicating a strong approval of the students with the utilization of problem-based learning in science teaching. These results align with Pozuelo-Muñoz et al. (2023), who concluded that Problem-based learning strategies significantly enhance student engagement, promote the application of scientific knowledge, and develop essential thinking and problem-solving skills in real-world contexts.

Level of Science Literacy Skills of the first year BSEd Students

In this study, the level of Science Literacy Skills of the first year BSEd Students refers to Procedural Literacy Level, Nominal Literacy Level, Functional Literacy Level, and Multidimensional Literacy Level.

TABLE 5. Level of Science Literacy Skills of students in terms of Procedural Literacy Level

Score	F	%	Descriptive Equivalent
13 - 15	0	0.00	Outstanding
10 - 12	2	5.00	Very Satisfactory
7 - 9	8	20.00	Satisfactory
4 - 6	23	57.50	Fairly Satisfactory
0 - 3	7	17.50	Did not meet Expectation
Total	40	100	
Weighted Mean	5.30		
SD	1.911		
Verbal Interpretation	Fairly Satisfactory		

Table 5 showed that the procedural literacy level of first-year BSEd students was predominantly "Fairly Satisfactory", consisted of 57.50%, with a weighted mean of 5.30. A significant portion of 17.50% did not meet expectations, while only 5% achieved a "Very Satisfactory" rating. No students scored in the "Outstanding" range, indicating a need for improvement in procedural science literacy. The standard deviation of 1.911 suggested a moderate variability in performance, with most students clustering in the lower score brackets. This implies that foundational procedural skills—such as following scientific methods and processes—require reinforcement through targeted instruction or practice-based learning. These results are aligned with the study of Zhang and Zhao (2020), who argued that enhancing procedural literacy, especially the ability to follow scientific inquiry processes, requires not only theoretical understanding but also hands-on application and reflective practice in the classroom.

TABLE 6. Level of Science Literacy Skills of the students in terms of Nominal Literacy Level

Score	f	%	Descriptive Equivalent
13 - 15	1	2.50	Outstanding
10 - 12	7	17.50	Very Satisfactory
7 - 9	15	37.50	Satisfactory
4 - 6	16	40.00	Fairly Satisfactory
0 - 3	1	2.50	Did not meet Expectation
Total	40	100	
Weighted Mean	7.03		
SD	2.337		
Verbal Interpretation	Satisfactory		

Table 6 shows the level of Science Literacy Skills of the first year BSEd Students in terms of Nominal Literacy Level. With a weighted mean of 7.03 the level of nominal literacy skills of the students was perceived as "Satisfactory" with a standard deviation of 2.337. While 40% fell under "Fairly Satisfactory," a notable 37.50% were "Satisfactory," and 17.50% reached "Very Satisfactory." Only 2.50% scored in the "Outstanding" and "Did Not Meet Expectation" categories. The higher mean and broader score distribution suggested that students have a reasonable grasp of basic scientific terminology and concepts, though some still struggle. This dimension appears stronger than procedural literacy, but further reinforcement could help elevate more students to higher proficiency levels. This aligns with the findings of Williams and Otrel-Cass (2016), who noted that while students often exhibit basic nominal science literacy, deeper

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understanding and more advanced knowledge require continued instructional efforts and contextualization in real-world science scenarios.

TABLE 7. Level of Science Literacy Skills of the students in terms of Functional Literacy Level

Score	f	%	Descriptive Equivalent
13 - 15	2	5.00	Outstanding
10 - 12	18	45.00	Very Satisfactory
7 - 9	12	30.00	Satisfactory
4 - 6	8	20.00	Fairly Satisfactory
0 - 3	0	0.00	Did not meet Expectation
Total	40	100	
Weighted Mean	9.03		
SD	2.577		
Verbal Interpretation	Satisfactory		

Table 7 shows that level of science literacy skills of the students in terms Functional Literacy Skills garnered a remark of "Satisfactory" with a weighted mean of 9.03. A strong 45% of students scored "Very Satisfactory," and 5% even reached "Outstanding." Only 20% remained in the "Fairly Satisfactory" range, with none failing to meet expectations. The standard deviation of 2.577 indicated that some variability, but the high percentage of students in the upper categories suggests that most can apply scientific knowledge effectively in practical contexts. This strength in functional literacy—which involves problem-solving and real-world application—may reflect well-developed analytical skills among the students.

Table 8 shows that multidimensional literacy level of the students which got a remark of "Satisfactory" with a weighted mean of 8.68. It is shown that 45% of students in this category achieved a remark of "Satisfactory". Notably, 10% achieved "Outstanding," and 22.50% were "Very Satisfactory," while another 22.50% remained "Fairly Satisfactory." The absence of scores in the lowest bracket is positive, but the relatively high standard deviation of 2.795 suggests varied competency in integrating multiple scientific perspectives. Since this dimension assesses higher-order thinking (e.g., interdisciplinary connections), the results indicate that while some students excel, others may need more structured guidance to develop critical and integrative science literacy skills. This aligns with the findings of Zhang et al. (2022), who emphasized that multidimensional literacy, which requires the integration of knowledge across different scientific domains, is essential for fostering critical thinking and interdisciplinary problem-solving in science education.

TABLE 8. Level of Science Literacy Skills of students in terms of Multidimensional Literacy Level

Score	f	%	Descriptive Equivalent
13 - 15	4	10.00	Outstanding
10 - 12	9	22.50	Very Satisfactory
7 - 9	18	45.00	Satisfactory
4 - 6	9	22.50	Fairly Satisfactory
0 - 3	0	0.00	Did not meet Expectation
Total	40	100	
Weighted Mean	8.68		
SD	2.795		
Verbal Interpretation	Satisfactory		

Level of Confidence Rate Index (CRI)

The confidence level of first-year Bachelor of Secondary Education (BSEd) students was assessed based on their test scores across four key levels of Science Literacy Skills-procedural, nominal, functional, and multi-dimensional levels.

TABLE 9. Level of Confidence Rate Index of students based on the result of the scores

Score	P		lominal		Functional		Multi-Dimensional		Descriptive Equivalent
	f	%	f	%	f	%	f	%	
49 - 60	4	10.00	11	27.50	7	17.50	5	12.50	Outstanding
37 - 48	19	47.50	22	55.00	18	45.00	17	42.50	Very Satisfactory
25 - 36	15	37.50	7	17.50	14	35.00	13	32.50	Satisfactory
13 - 24	2	5.00	0	0.00	1	2.50	5	12.50	Fairly Satisfactory
0 - 12	0	0.00	0	0.00	0	0.00	0	0.00	Did not meet Expectation
Total	40	100	40	100	40	100	40	100	
Weighted Mean	38.13		43.83		40.55		38.15		
SD	8.336		7.383		8.590		9.757		
Verbal Interpretation	Very Satisfactory		Very Satisfactory		Very Satisfactory		Very Satisfactory		

The table 9 showed the confidence levels of first-year Bachelor of Secondary Education (BSEd) students across four key dimensions: procedural, nominal, functional, and multi-dimensional. The results showed that the majority of students fall under the "Very Satisfactory" category in all areas, with the highest percentage of 55% in the nominal dimension, followed by procedural with 47.50%, functional with 45%, and multi-dimensional with 42.50%. A notable 27.50% of students achieved an "Outstanding" rating in the nominal dimension, indicating particularly strong confidence in this area. Meanwhile, the "Satisfactory" category was most prominent in the procedural dimension with 37.50% which suggested room for improvement. Only a small percentage of students scored in the lower brackets, with the multi-dimensional dimension having the highest proportion with 12.50% in the "Fairly Satisfactory" range.

The weighted means further support these findings, with all dimensions rated as "Very Satisfactory." The nominal dimension had the highest mean of 43.83, reinforcing its strength, while the multi-dimensional dimension had the lowest with a mean of 38.15, aligning with its slightly weaker performance. The standard deviation of 9.757 revealed variability in responses, with the multi-dimensional dimension showing the highest dispersion, indicating diverse confidence levels among students. In contrast, the nominal dimension had the most consistent scores with a standard deviation of 7.383.

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Test of Relationship between the Science Teaching Approaches and the Science Literacy Skills of the first year BSEd Students

To test the significant relationship between the Science Teaching Approaches and the Science Literacy Skills of the first year BSEd Students in terms of Procedural Literacy Level, Nominal Literacy Level, Functional Literacy Level, and Multidimensional Literacy Level they were treated statistically using Real Statistics Data Analysis Tools using the Pearson product moment correlation coefficient. These findings aligned with the study of Johnson et al. (2019), who found that students' confidence levels in science literacy dimensions often correlate with their performance, with more familiar domains like nominal literacy showing greater consistency and confidence compared to more complex, integrative dimensions like multi-dimensional literacy.

TABLE 10. Significant Relationship between the Science Teaching Approaches and the Science Literacy Skills of the students

Science Teaching Approaches		Science Literacy Skills of the first year BSEd Students			
		Procedura Literacy Level	Nomina Literacy Level	Functiona Literacy Level	Multidimensional Literacy Level
Inquiry-Based Learning	Pearson Correlation				
	Significance	0.2313	0.3277	0.0504	0.1124
	(2-Tailed)	0.0000	0.0000	0.0000	0.0000
	N	39	39	39	39
	Analysis	Sig	Sig	Sig	Sig
Constructivis Approach	Pearson Correlation				
	Significance	0.0786	0.2053	0.0220	0.0471
	(2-Tailed)	0.0000	0.0000	0.0000	0.0000
	N	39	39	39	39
	Analysis	Sig	Sig	Sig	Sig
Collaborativ Learning	Pearson Correlation				
	Significance	-0.1163	-0.0706	-0.1938	-0.0544
	(2-Tailed)	0.0000	0.0000	0.0000	0.0000
	N	39	39	39	39
	Analysis	Sig	Sig	Sig	Sig
Problem-based Learning	Pearson Correlation				
	Significance	0.1674	0.3224	0.1466	0.3410
	(2-Tailed)	0.0000	0.0000	0.0000	0.0000
	N	39	39	39	39
	Analysis	Sig	Sig	Sig	Sig

Table 10 showed the significant relationship between the science teaching approaches and the science literacy skills of the students. These results revealed a significant relationship between Science Teaching Approaches and the Science Literacy Skills of first-year BSEd students. The Pearson correlation results indicate that Inquiry-Based Learning, the Constructivist Approach, and Problem-Based Learning show weak positive correlations with Procedural, Nominal, Functional, and Multidimensional Literacy Levels. This suggests that these teaching approaches contribute positively to students' science literacy development, particularly in fostering critical thinking, problem-solving, and application of scientific concepts. However, Collaborative Learning exhibited negative correlations across all literacy levels, indicating that it may not be as effective in enhancing individual science literacy skills. These findings align with those of Zhang et al. (2021), who concluded that while inquiry-based and problem-based learning methods enhance critical thinking and practical science literacy, collaborative learning may not always foster individual mastery, particularly in diverse student groups with varying skill levels.

Table 11 shows the result of the test of the effect of employing science teaching approaches on the confidence rate index of the students.

TABLE 12. Test of effect of employing Science Teaching Approaches in Confidence Rate Index of the Students

Science Teaching Approaches	Beta Coefficients	t-value	p-value
Inquiry-based learning	-2.7651	-0.7441	0.4618
Constructivist Learning	-2.8465	-0.8324	0.4108
Collaborative learning	-3.131	-1.0791	0.2879
Problem-based learning	7.3548	1.6538	0.1071

$p < 0.05$ level of significance

The results showed an F-value of 0.8904 with a p-value of 0.4799, which is greater than the 0.05 level of significance. This suggests that variations in Science Teaching Approaches do not significantly predict students' confidence in their science literacy skills.

Further analysis of the regression coefficients shows that Problem-Based Learning has the highest positive coefficient of 16.383, suggesting a potential positive effect on confidence, but a p-value of 0.1071 indicates that this effect is not statistically significant. Similarly, Inquiry-Based Learning, Constructivist Approach, and Collaborative Learning also show no significant predictive power over confidence levels, as indicated by their high p-values (all above 0.05).

These findings imply that while Science Teaching Approaches may influence students' literacy skills, they do not directly affect their confidence levels. Other factors, such as students' prior knowledge, learning experiences, motivation, assessment strategies, and classroom environment, might play a more crucial role in shaping their confidence in science literacy (Chen and Wang, 2020).

IV. Conclusion and Recommendations

Science teaching approaches had a significant relationship on all indicators of science literacy skills of the students leading to the rejection of the null hypothesis. This concluded that employing various science teaching approaches in the teaching-learning can influence the level of the science literacy of the students.

The acceptance of the null hypothesis was caused by the fact that science teaching methods had no notable impact on the students' confidence rate index. This concluded that employing these various teaching approaches did not collectively affect how confident students can be in answering science-related inquiries.

Based on the findings and conclusions drawn, the following were recommended

Science college instructors may focus on improving Procedural Literacy by integrating more structured experiments and guided scientific investigations into the curriculum. Collaborative and inquiry-based learning

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approaches should be further optimized to maximize their impact on science literacy.

Colleges or programs offering Bachelor of Secondary Education major in science may also equip teachers with advanced pedagogical techniques that foster scientific literacy effectively.

Future research should investigate other factors affecting students' confidence levels and examine the long-term impact of different instructional strategies on science literacy.

REFERENCE

[1]. Anderson, C. W., De Los Santos, E. X., Bodbyl, S., Covitt, B. A., Edwards, K. D., Hancock, J. B., Lin, Q., Thomas, C. M., Penuel, W. R., & Welch, M. M. (2018). Designing educational systems to support enactment of the Next Generation Science Standards. Journal of Research in Science Teaching, 55(7), 1026–1052. https://doi.org/10.1002/tea.21484

[2]. Chen, L., & Wang, H. (2022). The role of learning environment and resources in science literacy. Journal of Science Education, 45(3), 234-245. https://doi.org/10.1016/j.jse.2022.04.003

[3]. Johnson, R. B., & Christensen, L. (2020). Educational research: Quantitative, qualitative, and mixed approaches (7th ed.). SAGE Publications.

[4]. Liu, J., Aziku, M., Qiang, F., & Zhang, B. (2024). Leveraging professional learning communities in linking digital professional development and instructional integration: evidence from 16,072 STEM teachers. International Journal of STEM Education, 11(1). https://doi.org/10.1186/s40594-024-00513-3

[5]. Pozuelo-Muñoz, J., Calvo-Zueco, E., Sánchez-Sánchez, E., & Cascarosa-Salillas, E. (2023). Science Skills Development through Problem-Based Learning in Secondary Education. Education Sciences, 13(11), 1096. https://doi.org/10.3390/educsci13111096

[6]. She, H., Lin, H., & Huang, L. (2019). Reflections on and implications of the Programme for International Student Assessment 2015 (PISA 2015) performance of students in Taiwan: The role of epistemic beliefs about science in scientific literacy. Journal of Research in Science Teaching, 56(10), 1309–1340. https://doi.org/10.1002/tea.21553

[7]. Wang, H., Chen, S., & Yen, M. (2021). Effects of metacognitive scaffolding on students' performance and confidence judgments in simulation-based inquiry. Physical Review Physics Education Research, 17(2). https://doi.org/10.1103/physrevphyseducres.17.020108

[8]. Williams, P. J., & Otrel-Cass, K. (2016). ICT-rich science inquiry. International Journal of Science Education, 38(1), 24–40.

[9]. Zhang, L., Liu, X., & Feng, H. (2023). Development and validation of an instrument for assessing scientific literacy from junior to senior high school. Disciplinary and Interdisciplinary Science Education Research, 5(1). https://doi.org/10.1186/s43031-023-00093-2