Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Artificial Intelligince Literacy and Research Competence of Senior High School Student in SDO Calaca City

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Publication Date: June 1, 2026 DOI: **10.5281/zenodo.20491151**

Abstract

This study examined the relationship between artificial intelligence (AI) literacy and research competence among Senior High School students in the Schools Division of Calaca City during the school year 2025–2026. It assessed students' AI literacy in terms of access, knowledge and understanding, usage and application, and evaluation, as well as their research competence in terms of problem identification and conceptualization, information literacy and synthesis, and research design and application. The study also identified teacher-reported challenges in promoting these competencies and proposed an instructional intervention based on the findings.

Using a descriptive-quantitative research design, data were gathered from 350 Senior High School students selected through stratified random sampling. Structured four-point Likert scale questionnaires were used to measure AI literacy, research competence, and teacher-related challenges, while selected teacher responses provided contextual support for the quantitative findings. Data were analyzed using descriptive statistics and Pearson product-moment correlation.

Results revealed that students were slightly literate in AI, with evaluation emerging as the weakest dimension, indicating limited ability to assess the accuracy, reliability, and ethical implications of AI-generated outputs. Students were also slightly competent in research, with citation and referencing identified as the weakest area. Pearson correlation analysis showed a strong, statistically significant positive relationship between AI literacy and research competence, $r = .705$, $p < .001$. Teacher-reported challenges included limited institutional policy support for AI use, technological constraints, reduced opportunities for meaningful teacher-student interaction, and heavy workloads that limited sustained research mentoring.

Based on these findings, the study proposed the AI-Augmented Research Toolkit (AART), a structured instructional material designed to support ethical and research-oriented AI integration. The toolkit adopts a Human–AI–Human workflow that emphasizes critical evaluation, source verification, synthesis, citation checking, and responsible use of AI-generated content. The study recommends the development of clear institutional AI policies and targeted professional development programs to strengthen students' and teachers' evaluative, ethical, and research-related competencies.

Keywords: *artificial intelligence literacy, research competence, senior high school students, AI integration, research instruction, academic integrity*

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Introduction

Artificial intelligence (AI) has become increasingly embedded in education, influencing how students access information, complete academic tasks, and engage in research-related activities. While AI-powered tools offer opportunities for personalized learning, improved access to information, and more efficient academic work, their growing use also raises concerns about academic integrity, overreliance on AI-generated content, misinformation, bias, and limited critical evaluation. These concerns highlight the need for students to develop AI literacy, particularly the ability to access, understand, use, and evaluate AI tools responsibly.

In Senior High School research instruction, the increasing use of AI tools has introduced both opportunities and challenges. While these tools may support students in accessing information, organizing ideas, and improving academic productivity, they also require learners to exercise judgment in evaluating accuracy, credibility, ethical use, and originality. At the same time, students are expected to develop research competence, particularly in identifying research problems, synthesizing information, and applying appropriate research procedures. However, limited empirical attention has been given to how students' AI literacy relates to their research competence in secondary education. This gap provides the basis for examining both competencies and for developing instructional materials that promote responsible and research-oriented use of AI.

This study determined the level of AI literacy and research competence among Senior High School students in SDO Calaca City during the School Year 2025–2026. The findings served as the basis for proposing AI-integrated learning materials for Research aimed at strengthening students' responsible use of AI and improving their research-related skills. Specifically, the study sought to answer the following questions:

1. What is the students' level of AI literacy as assessed by the students themselves relative to access, knowledge and understanding, usage and application, and evaluation?
2. What is the respondents' level of research competence in terms of problem identification and conceptualization, information literacy and synthesis, and research design and application?
3. Is there a significant relationship between the students' level of AI literacy and their level of research competence?
4. What challenges do teachers face in promoting AI literacy and research competence among Senior High School students?
5. What AI-integrated materials for Research may be proposed?

Online ISSN: 3082-5121
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https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Methodology

Research Design

This study employed a **descriptive quantitative research design**, supplemented by qualitative data for enrichment. The quantitative component was used to determine the students' level of AI literacy, their level of research competence, the significance of the relationship between these two variables, and the extent of challenges encountered by teachers in promoting AI literacy and research competence among Senior High School students. To complement the quantitative findings, semi-structured interviews were conducted with selected Research teachers. The interview data were not treated as a separate qualitative strand but were used to provide contextual support and deeper interpretation of the quantitative results, particularly those concerning teacher-reported challenges.

Participants

The participants were Senior High School students and Research teachers from public and private schools under SDO Calaca City during the school year 2025–2026. The student respondents were enrolled in Practical Research 1, Practical Research 2, or Inquiries, Investigations, and Immersion. Using Slovin's formula with a 5% margin of error, 350 students were selected from a population of 2,759 through **stratified random sampling with proportionate allocation**. The teacher respondents consisted of 22 Senior High School Research teachers, who were included through **total enumeration**. Of these, 11 answered the teacher questionnaire, while the remaining 11 participated in semi-structured interviews.

Research Instrument

Researcher-made questionnaires and semi-structured interview guide questions were developed and validated to gather data on the main variables of the study. The instruments measured:

- Students' AI literacy
- Students' research competence
- Teachers' challenges in promoting AI literacy and research
- Teachers' supporting insights on instructional barriers, needs, and experiences related to AI literacy and research instruction

The questionnaires used a **four-point Likert scale** to generate quantitative data, while the semi-structured interview guide was used to gather supplementary qualitative information for contextualizing the quantitative findings.

Online ISSN: 3082-5121
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https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Data Collection Procedure

Formal approval was first secured from the Schools Division Superintendent of SDO Calaca City. After approval, letters were sent to the principals of the participating public and private Senior High Schools. Consent from respondents and, when necessary, from parents or guardians was obtained before data collection.

The questionnaires were administered either in printed form or through Google Forms, depending on respondent accessibility and preference. The semi-structured interviews were conducted with selected Research teachers either in person or online. All data were handled in accordance with the Data Privacy Act of 2012. Digital files were stored in password-protected folders, while printed documents were kept securely and accessed only by the researcher.

Data Analysis

Quantitative data were analyzed using **mean, standard deviation, and Pearson's r product–moment correlation coefficient**. Mean and standard deviation were used to determine the level of students' AI literacy, level of research competence, and extent of teacher-reported challenges. Pearson's r was used to determine the strength, direction, and significance of the relationship between AI literacy and research competence. Interview responses were organized according to recurring points and used only to enrich and contextualize the interpretation of the quantitative results.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Results

Section 1: Students' Level of AI Literacy

Table 1
Students' Assessment on their Level of AI Literacy in terms of Access

Indicators	WM	SD	VI	Rank
1. Identifying artificial intelligence tools that can be used to help with school research tasks.	1.686	.6366	SL	10
2. Locating information about school rules or guidelines on using AI for research work.	2.017	.7259	SL	2
3. Recognizing differences between commonly available AI tools and more advanced or restricted ones for research use.	1.923	.7920	SL	3
4. Knowing which school offices or services can help students access AI tools for research.	2.111	.7732	SL	1
5. Noticing AI-related features available in the digital platforms used for research and academic tasks.	1.849	.7397	SL	4
6. Being aware of AI-related tools that support research activities such as reading sources, organizing information, or writing.	1.737	.6851	SL	6
7. Finding guides, tutorials, or learning materials that explain how AI may be used in research work.	1.731	.6871	SL	7
8. Understanding the device or software requirements needed to access certain AI tools for research.	1.774	.6753	SL	5
9. Checking where to find information about data privacy and safety when using AI for research purposes.	1.726	.7175	SL	9
10. Determining whether an AI tool can be used for research in a specific subject or course.	1.729	.6450	SL	8
Composite Mean	**1.8283**	**.47755**	**Slightly Literate**	

Legend: *3.50-4.00 - Highly Literate | 2.50-3.49 – Moderately Literate | 1.50-2.49 – Slightly Literate | 1.00-1.49 – Least Literate*

1.1 Access. The respondents' level of AI literacy in terms of access obtained a composite mean of 1.8283, interpreted as Slightly Literate (SL). This indicates that students have limited ability to independently locate and utilize AI tools for academic purposes. While they demonstrate relatively greater awareness of institutional support, such as school offices and guidelines (WM = 2.111; WM = 2.017), they show less capability in identifying appropriate AI tools for research tasks (WM = 1.686). This suggests that students rely more on guided access rather than independent exploration of AI resources.

1.2 Knowledge and Understanding. The students' level of AI literacy in terms of knowledge and understanding yielded a composite mean of 1.7746, interpreted as Slightly Literate (SL). The findings indicate that students possess basic familiarity with applied AI concepts, particularly those related to user experience and system limitations (WM = 1.866; WM

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

= 1.823). However, they demonstrate difficulty in understanding fundamental distinctions between types of AI systems (WM = 1.700). This suggests that students' knowledge of AI is fragmented, with greater emphasis on surface-level concepts than on deeper theoretical understanding.

Table 2
Students' Assessment on their Level of AI Literacy in terms of Knowledge and Understanding

Indicators	WM	SD	VI	Rank
1. Differentiating between artificial intelligence designed for a single task and general artificial intelligence.	1.714	.6926	SL	9
2. Recognizing that the outputs of generative AI are based on patterns and probabilities rather than true understanding.	1.780	.6856	SL	5
3. Defining basic AI terms such as machine learning, neural networks, and natural language processing.	1.754	.6956	SL	7
4. Understanding how the quality and variety of training data affect the accuracy and fairness of AI systems.	1.766	.6617	SL	6
5. Identifying the difference between AI that creates new content and AI that mainly analyzes or searches existing information.	1.700	.6632	SL	10
6. Knowing what a knowledge cutoff is and how it limits an AI's ability to give current information.	1.749	.7298	SL	8
7. Explaining how human feedback helps improve AI systems over time.	1.797	.6909	SL	3.5
8. Recognizing when a software feature uses AI instead of simple rule-based programming.	1.797	.7032	SL	3.5
9. Understanding how limits such as tokens or parameters affect how much information an AI can process at one time.	1.823	.7627	SL	2
10. Describing how human-centered design helps make AI applications easier to use.	1.866	.7235	SL	1
Composite Mean	**1.7746**	**.47801**	**Slightly Literate**	

Legend: *3.50-4.00 - Highly Literate | 2.50-3.49 – Moderately Literate | 1.50-2.49 – Slightly Literate | 1.00-1.49 – Least Literate*

1.3 Usage and Application. The students' assessment of their level of AI literacy in terms of usage and application resulted in a composite mean of 1.7871, interpreted as Slightly Literate (SL). The results show that students are more capable of using AI for generating initial research outputs, such as outlines and draft structures (WM = 1.871) and navigating AI tools (WM = 1.817). However, they experience difficulty in integrating AI-generated information into their own work (WM = 1.709). This indicates that students tend to use AI for surface-level assistance rather than for deeper cognitive engagement and critical application.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Table 3
Students' Assessment on their Level of AI Literacy in terms of Usage and Application

Indicators	WM	SD	VI	Rank
1. Navigating different AI tool interfaces to access features that support research tasks.	1.817	.6735	SL	2
2. Formulating clear prompts that include relevant research context or instructions.	1.797	.7986	SL	6
3. Refining prompts or questions to improve the quality of AI-generated research outputs.	1.731	.6995	SL	9
4. Summarizing and organizing key ideas from academic readings using AI tools.	1.806	.7036	SL	5
5. Generating research outlines, possible research questions, or early draft structures with AI support.	1.871	.7705	SL	1
6. Using AI to better understand research-related concepts by asking for simpler explanations or examples.	1.760	.7453	SL	7.5
7. Applying AI to assist with research-related technical tasks such as translating text, formatting data, or basic coding.	1.809	.7264	SL	4
8. Selecting an appropriate AI tool based on the needs of a specific research task.	1.760	.6810	SL	7.5
9. Integrating AI-generated information into research work while maintaining personal understanding and expression.	1.709	.6944	SL	10
10. Exploring research ideas by using AI to test explanations, consider alternative views, or refine arguments.	1.811	.6887	SL	3
Composite Mean	**1.7871**	**.50514**	**Slightly Literate**	

Legend: *3.50-4.00 - Highly Literate | 2.50-3.49 – Moderately Literate | 1.50-2.49 – Slightly Literate | 1.00-1.49 – Least Literate*

Table 4
Students' Assessment on their Level of AI Literacy in terms of Evaluation

Indicators	WM	SD	VI	Rank
1. Verifying information from AI by comparing it with textbooks or reliable academic sources.	1.660	.7580	SL	6
2. Detecting incorrect or made-up information in AI responses that sound convincing.	1.637	.7160	SL	8
3. Checking whether citations or references given by AI match real and existing publications.	1.574	.7859	SL	10
4. Identifying possible biases in AI-generated research content, such as stereotypes or unfair representations.	1.686	.7289	SL	3.5
5. Evaluating the limits of an AI tool after using it for research tasks.	1.717	.7241	SL	1.5
6. Looking for logical errors or contradictions in long research responses produced by AI.	1.717	.7398	SL	1.5
7. Judging whether AI-generated information fits the topic, level, or purpose of a research task.	1.686	.6673	SL	3.5
8. Recognizing the risk of misinformation or unverified content when using AI during research.	1.606	.6720	SL	9
9. Assessing the credibility of an AI tool based on available information about how it was developed or trained.	1.649	.7097	SL	7
10. Deciding not to use AI outputs when they may weaken the quality or integrity of research work.	1.671	.7555	SL	5
Composite Mean	**1.6603**	**.50871**	**Slightly Literate**	

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Legend: *3.50-4.00 - Highly Literate | 2.50-3.49 – Moderately Literate | 1.50-2.49 – Slightly Literate | 1.00-1.49 – Least Literate*

1.4 Evaluation. The assessment of the students' level of AI literacy in terms of evaluation yielded a composite mean of 1.6603, interpreted as Slightly Literate (SL), making it the lowest among all AI literacy dimensions. While students show some ability to recognize logical inconsistencies and limitations in AI outputs (WM = 1.717), they demonstrate significant difficulty in verifying sources and checking the accuracy of citations (WM = 1.574). This suggests limited development of higher-order evaluative skills, particularly in validating the credibility of AI-generated information, which is essential for academic research.

Section 2: Students' Level of Research Competence

Table 5
Students' Assessment on their Level of Research Competency in terms of Problem Identification and Conceptualization

Indicators	WM	SD	VI	Rank
1. Creating a research title that clearly reflects the study's purpose and target group.	1.683	.7452	SC	4
2. Narrowing a broad topic into a clear and manageable research problem.	1.700	.7291	SC	2
3. Identifying a specific research gap that has not been clearly addressed in previous studies.	1.666	.6853	SC	7
4. Explaining the possible academic or practical value of the research problem.	1.663	.7186	SC	8
5. Determining the main objectives of a research project at the beginning of the study.	1.691	.7392	SC	3
6. Formulating focused research questions that guide the direction of the study.	1.680	.6900	SC	5
7. Developing research hypotheses based on existing theories or studies.	1.674	.6353	SC	6
8. Defining the scope, boundaries, and limits of a research project.	1.611	.7084	SC	10
9. Distinguishing between descriptive, relational, and causal research problems.	1.657	.6531	SC	9
10. Constructing a conceptual or theoretical framework that connects key variables in the study.	1.723	.7063	SC	1
Composite Mean	**1.6749**	**.52233**	**Slightly Competent**	

Legend: *3.50-4.00 - Highly Competent | 2.50-3.49 – Moderately Competent | 1.50-2.49 – Slightly Competent | 1.00-1.49 – Least Competent*

2.1 Problem Identification and Conceptualization. The assessment of the students' level of research competence in terms of problem identification and conceptualization resulted in a composite mean of 1.6749, interpreted as Slightly Competent (SC). The indicator constructing a conceptual or theoretical framework that connects key variables in the study ranked the highest (WM = 1.723), followed by narrowing a broad topic into a clear and manageable research problem (WM = 1.700). In contrast, defining the scope, boundaries, and limits of a research project obtained the lowest weighted mean of 1.611. These results indicate that while students demonstrate a basic understanding of how research components are structured, they experience

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

difficulty in refining and delimiting research problems with precision, suggesting a gap between general conceptual understanding and methodological clarity.

2.2 Information Literacy and Synthesis. The respondents' level of research competence in terms of information literacy and synthesis obtained a composite mean of 1.5911, interpreted as Slightly Competent (SC). The indicator integrating theories or models from the literature to describe the current state of research ranked the highest (WM = 1.731), followed by combining findings from different studies into a clear and connected discussion (WM = 1.680). Meanwhile, applying proper citation and referencing styles to acknowledge sources correctly received the lowest weighted mean of 1.491, with a verbal interpretation of Least Competent (LC). These findings suggest that although students are capable of synthesizing ideas at a conceptual level, they struggle with the technical aspects of academic writing, particularly in proper citation and source documentation, which are essential for maintaining academic integrity.

Table 6
Students' Assessment on their Level of Research Competency in terms of Information Literacy and Synthesis

Indicators	WM	SD	VI	Rank
1. Searching for relevant academic sources using digital libraries or online databases.	1.569	.7297	SC	6
2. Evaluating the credibility of research sources based on author, date, and publication quality.	1.566	.7141	SC	7
3. Assessing the quality of research studies before including them in a review.	1.560	.6384	SC	8
4. Identifying the main findings of studies related to a research topic.	1.586	.6620	SC	4
5. Recognizing common themes or patterns across multiple research sources.	1.580	.6407	SC	5
6. Summarizing key ideas from complex texts, tables, or visual data.	1.623	.7305	SC	3
7. Organizing research articles and references in a systematic manner.	1.526	.6670	SC	9
8. Combining findings from different studies into a clear and connected discussion.	1.680	.7185	SC	2
9. Integrating theories or models from the literature to describe the current state of research.	1.731	.7117	SC	1
10. Applying proper citation and referencing styles to acknowledge sources correctly.	1.491	.6802	LC	10
Composite Mean	**1.5911**	**.50466**	**Slightly Competent**	

Legend: *3.50-4.00 - Highly Competent | 2.50-3.49 – Moderately Competent | 1.50-2.49 – Slightly Competent | 1.00-1.49 – Least Competent*

2.3 Research Design and Application. The students' assessment of their level of research competence in terms of research design and application resulted in a composite mean of 1.5857, interpreted as Slightly Competent (SC). The indicator planning a research design that fits the research questions and objectives ranked the highest (WM = 1.651), followed by choosing suitable sampling methods for collecting research data (WM = 1.640). Conversely, presenting research findings clearly through written reports and oral presentations obtained the lowest weighted mean of 1.529. These results indicate that students are relatively more capable of

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

planning research procedures but encounter difficulties in executing and communicating research outputs, suggesting a gap between research planning and actual implementation.

Table 7
Students' Assessment on their Level of Research Competency in terms of Research Design and Application

Indicators	WM	SD	VI	Rank
1. Selecting an appropriate research approach (qualitative, quantitative, or mixed methods) for a study.	1.560	.8157	SC	6.5
2. Planning a research design that fits the research questions and objectives.	1.651	.6927	SC	1
3. Justifying the chosen research method based on its strengths and limitations.	1.634	.7004	SC	3
4. Aligning data collection tools with the selected research method.	1.583	.6403	SC	5
5. Choosing suitable sampling methods for collecting research data.	1.640	.7695	SC	2
6. Following research procedures in an organized and ethical manner.	1.554	.7579	SC	8
7. Using basic data analysis tools or software to process research results.	1.600	.6728	SC	4
8. Ensuring the accuracy and reliability of research findings.	1.546	.7393	SC	9
9. Interpreting research results based on collected data and research questions.	1.560	.7226	SC	6.5
10. Presenting research findings clearly through written reports and oral presentations.	1.529	.6754	SC	10
Composite Mean	**1.5857**	**.58699**	**Slightly Competent**	

Legend: *3.50-4.00 - Highly Competent | 2.50-3.49 – Moderately Competent | 1.50-2.49 – Slightly Competent | 1.00-1.49 – Least Competent*

Section 3: Relationship Between AI Literacy and Research Competence

The analysis of the relationship between the students' assessment of their levels of AI literacy and their research competence yielded a Pearson r value of .705 with a corresponding p-value of < .001. Since the p-value is less than the 0.05 level of significance, the null hypothesis is rejected, indicating a statistically significant positive relationship between the two variables, interpreted as a strong association. The results suggest that students with higher levels of AI literacy tend to demonstrate higher levels of research competence, highlighting the close connection between their ability to understand and utilize AI tools and their performance in research-related tasks. Notably, the evaluation dimension of AI literacy, although identified as the weakest among students, consistently showed the strongest relationships with all areas of research competence, indicating that higher-order evaluative skills such as verifying information and assessing credibility are particularly important in supporting effective research practices.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Table 8
Relationship between the Students' Assessment of their Level of AI Literacy and their Level of Research Competence

Variable	Pearson r Value	p-value	Decision on H_o	Interpretation
Students' Assessment of their Levels of AI Literacy and Research Competence	.705	.000	Reject H_o	Significant

$p < 0.05$ Statistically Significant

Section 4: Challenges in Promoting AI Literacy and Research Competence

Table 9
Teachers' Challenges in Promoting AI Literacy

Indicators	WM	SD	VI	Rank
1. I struggle to integrate AI into my lessons because of unreliable internet connectivity or frequent hardware glitches at my school.	3.500	.5118	SA	2.5
2. I worry that over-reliance on AI tools will reduce the meaningful, human-centered interaction I have with my students.	3.500	.5118	SA	2.5
3. I am deeply concerned about how third-party AI developers handle and store my students' sensitive data.	2.773	.4289	A	8
4. I feel that my current professional development has not adequately prepared me with the practical skills to use AI in my specific subject area.	2.636	.4924	A	9
5. The high cost of premium AI tool subscriptions is a major hurdle that prevents me from adopting these technologies in my classroom.	3.409	.5903	A	6
6. I find it difficult to trust AI outputs because I am concerned they may reflect cultural or demographic biases.	1.955	.7223	D	10
7. I struggle to design assessment methods that effectively prevent students from using AI to bypass original cognitive effort.	3.455	.5958	A	4.5
8. I experience a sense of professional anxiety when I am tasked with using AI technologies that I do not fully understand.	2.863	.6396	A	7
9. My institution lacks a clear, comprehensive policy to guide my ethical and responsible use of generative AI tools.	3.636	.4924	SA	1
10. I believe that the instant answers provided by AI tools are eroding my students' natural curiosity and their ability to think critically.	3.455	.5958	A	4.5
Composite Mean	**3.118**	**.55811**	**Agree**	

Legend: *3.50-4.00 – Strongly Agree | 2.50-3.49 – Agree | 1.50-2.49 – Disagree | 1.00-1.49 – Strongly Disagree*

The challenges faced by teachers in promoting AI literacy and research competence yielded composite means of 3.118 and 3.382, respectively, both interpreted as Agree (A), indicating that educators generally experience notable constraints in supporting these competencies. The primary challenge in AI literacy is the lack of a clear institutional policy to guide ethical AI use (WM = 3.636), while in research competence, the most significant barrier is heavy teaching loads and administrative duties (WM = 3.909). These findings suggest that institutional and structural factors, rather than pedagogical limitations, are the dominant

Online ISSN: 3082-5121
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https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

obstacles in developing student competencies. Conversely, teachers expressed the least concern regarding distrust of AI due to cultural biases (WM = 1.955) and assisting students in crafting research questions and hypotheses (WM = 2.409), indicating that conceptual guidance is less problematic compared to systemic constraints such as workload and lack of policy support.

Table 10
Teachers' Challenges in Promoting Research Competence

Indicators	WM	SD	VI	Rank
1. Guiding students in designing research studies, analyzing data, and interpreting results is challenging due to the complexity of research methods.	3.318	.4767	A	7.5
2. Helping students craft clear research questions, hypotheses, and coherent study frameworks is difficult.	2.409	.5032	D	10
3. I find it hard to assist students in writing formal research reports and using proper citation and documentation styles.	2.636	.4924	A	9
4. Limited access to academic resources, journals, and research facilities hinders my ability to support students' research projects.	3.727	.4558	SA	3
5. Heavy teaching loads and administrative duties leave me little time to mentor and supervise student research effectively.	3.909	.2942	SA	1
6. Lack of institutional guidance, mentorship, and feedback makes it challenging to develop students' research competence.	3.682	.4767	SA	4
7. School culture and policies do not always prioritize student-led research or provide sufficient incentives and support.	3.818	.3948	SA	2
8. Collaborating with other teachers, researchers, or external partners to enhance student research is difficult due to institutional barriers.	3.318	.5679	A	7.5
9. Curricular restrictions and frequent policy changes make it hard to integrate research projects into students' regular learning activities.	3.546	.5097	SA	5
10. Balancing my role as a teacher with guiding student research often creates stress and fatigue, affecting the quality of mentoring I can provide.	3.455	.5097	A	6
Composite Mean	**3.382**	**.46811**	**Agree**	

Legend: *3.50-4.00 – Strongly Agree | 2.50-3.49 – Agree | 1.50-2.49 – Disagree | 1.00-1.49 – Strongly Disagree*

Section 5: Proposed AI-Integrated Learning Materials for Research

Based on the identified gaps, the study proposed the AI-Augmented Research Toolkit (AART) as an instructional support material for Research. The toolkit was designed to address students' weak AI evaluation skills, difficulties in citation and research application, and teachers' need for structured guidance in promoting responsible AI use. It follows a Human–AI–Human workflow, emphasizing ethical prompting, critical verification, source checking, and the responsible integration of AI-generated content in research tasks.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Research Domain	Finding / Specific Gap	AART Module / Feature	Instructional Logic (How it addresses the gap)
AI Literacy: Access	WM 1.828 (Slightly Literate): Students rely on guided access and lack independent tool identification.	Module 1: The Ethical Prompt Engineer	Moves students from passive usage to Strategic Tool Selection. They learn to match specific research tasks (e.g., RRL vs. Data Analysis) to specialized AI models.
AI Literacy: Knowledge	WM 1.774 (Slightly Literate): Fragmented understanding; students struggle with system limitations.	Module 1: The Ethical Prompt Engineer	Focuses on System Literacy. Activities force students to identify where AI fails (hallucinations, cut-off dates), turning "fragmented" knowledge into "critical" knowledge.
AI Literacy: Usage	WM 1.709 (Difficulty in Integration): Students copy-paste rather than integrate AI information into their work.	Module 3: The Synthesis Engine	Uses the "Paraphrase Challenge" and "Voice Match" drills. It requires students to rewrite AI-generated drafts in their own voice before finalization.
AI Literacy: Evaluation	WM 1.574 (Lowest Score): Major difficulty in verifying sources and checking accuracy of citations.	Module 3: The Synthesis Engine + Auditor Worksheet	Implements a Mandatory Audit Trail. Students cannot include a claim unless they provide a verified, human-found link or DOI in their Auditor log.
Research: Problem Identification	WM 1.611 (Lowest Research Indicator): Struggle with defining the scope, boundaries, and limits.	Module 2: Problem Scoping & Gap Analysis	Employs the "Boundary Box" technique. AI is used to brainstorm broad topics, but the student is graded on their ability to restrict and delimit that topic manually.
Research: Information Literacy	WM 1.491 (Least Competent): Failure to apply proper citation and referencing styles.	Module 3: The Synthesis Engine + Ethical Compass	Direct instruction on AI-Human Attribution. It bridges the gap between AI outlines and formal APA 7th Edition technical writing.
Research: Design	WM 1.585 (Slightly Competent): Gap between planning procedures and actual execution/communication.	Module 4: The Research Architect	Includes the "Methodology Stress-Test." AI simulates potential flaws in their design (e.g., bias in sampling), and students must write the "mitigation plan" for it.
Teacher Challenges	WM 3.636 & 3.909: Lack of policy and heavy administrative/mentoring workload.	The Ethical Compass & Self-Guided Scaffolding	The Transparency Pledge acts as an instant "classroom policy." The modular, self-guided nature reduces the need for constant 1-on-1 teacher mentoring.
Practical Barriers	Infrastructural limitations: Inconsistent internet access in Calaca schools.	Offline-Ready Design	The workflow is split: AI-generation (Online/Synchronous) and the Auditor/Verification phase (Offline/Asynchronous).

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Discussion

The findings indicate that Senior High School students in SDO Calaca City had only a slight level of AI literacy and research competence. This suggests that although students may already be exposed to AI tools, their ability to use these tools critically, ethically, and independently for academic research remains limited. This result supports Casal-Otero et al. (2023), who emphasized that AI literacy in K-12 education should develop not only students' ability to access and use AI technologies, but also their understanding of AI's limitations, ethical implications, and responsible applications. The low result in the evaluation dimension further confirms the concern that students need stronger skills in verifying AI-generated information, assessing credibility, and checking the accuracy of citations.

The students' slight level of research competence also reflects gaps in essential research skills, particularly in citation and referencing, scope delimitation, and the presentation of research findings. These weaknesses suggest that students may possess basic conceptual awareness of research but still struggle with the technical and communicative aspects of academic inquiry. This finding is consistent with Adebisi (2022), who noted that student involvement in research requires systematic support in developing research skills, academic writing, and critical inquiry. Similarly, Alkema et al. (2023) emphasized that synthesis writing and source integration require explicit instruction, especially when students are expected to connect multiple sources into a coherent academic discussion.

The significant strong positive relationship between AI literacy and research competence shows that students with higher levels of AI literacy also tend to demonstrate stronger research-related abilities. This finding supports the view that AI literacy is not merely a digital skill but a research-enabling competence. In particular, the strong role of the evaluation dimension highlights the importance of critical judgment in AI-assisted research. This aligns with Southworth et al. (2023), who argued that AI literacy should be integrated across the curriculum to help students use AI meaningfully in academic tasks. It also supports Cardona, Rodríguez, and Ishmael (2023), who stressed that the educational use of AI must be accompanied by human judgment, critical evaluation, and responsible decision-making.

The teacher-reported challenges further explain the limited development of students' AI literacy and research competence. Teachers identified the lack of clear institutional policy on ethical AI use and heavy teaching loads and administrative duties as major constraints. These findings suggest that the promotion of AI literacy and research competence is not solely dependent on student ability, but also on institutional support, teacher preparedness, and manageable teaching conditions. This is consistent with UPOU's guidelines on AI use in teaching and learning, which emphasize the need for clear policies, ethical standards, and continuous professional development in the responsible integration of AI in education. Likewise, Tan et al. (2024) highlighted that teacher professional development is essential in helping educators adapt to AI-supported instruction.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 6 (2026)

Generally, the results justify the development of the AI-Augmented Research Toolkit (AART) as a structured instructional response to the identified gaps. Since students struggled most with evaluation, citation, and the responsible integration of AI-generated content, the toolkit's Human–AI–Human workflow is appropriate because it positions AI as a support tool rather than a replacement for student thinking. Through activities on ethical prompting, verification, synthesis, citation checking, and human revision, the AART addresses both student competency gaps and teacher-reported instructional challenges. This direction is consistent with Holmes, Bialik, and Fadel (2022), who emphasized that AI in education should enhance, rather than replace, human learning, judgment, and agency.

Conclusion

This study concluded that Senior High School students in SDO Calaca City had limited AI literacy and research competence, with notable gaps in evaluating AI-generated content and applying research conventions. The significant positive relationship between the two variables suggests that stronger AI literacy is associated with better research competence. However, unclear AI policies, technological constraints, limited teacher-student interaction, and heavy teacher workloads hindered their development. Thus, the proposed AI-Augmented Research Toolkit offers structured support for responsible AI use and improved research instruction.

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