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EVALUATING THE AI-ICE FRAMEWORK IN RESOURCE CONSTRAINED HIGHER EDUCATION: IMPLICATIONS FOR TEACHING STRATEGIES AND FACULTY DEVELOPMENT

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Abstract: Artificial intelligence (AI) offers opportunities for instructional innovation, yet limited evidence exists on structured AI-assisted pedagogical frameworks in resource-constrained educational contexts. Anchored on the Artificial Intelligence-Ideas, Connections, and Extensions (AI-ICE) Framework and supported by technology acceptance, behavioral, cognitive, constructivist, and pedagogical theories, this study evaluated AI-ICE utilization in selected local government-run colleges in Cebu. An explanatory sequential mixed methods design involved 155 faculty members. Quantitative data were analyzed using descriptive statistics and Pearson's correlation, while qualitative responses underwent thematic analysis. Students' academic performance was obtained from actual institutional pass-fail records for the First Semester of School Year 2025–2026. Findings revealed frequent AI-ICE utilization, particularly in Building Meaningful Connections. However, no significant relationships emerged between academic performance and Fostering Innovative Ideas ($r = .024$, $p = .765$), Building Meaningful Connections ($r = -.064$, $p = .428$), Creating Cognitive Extensions ($r = -.027$, $p = .736$), and Enhancing Teaching and Learning Strategies ($r = .014$, $p = .866$). Qualitative findings contextualized these results through barriers involving AI literacy, technological infrastructure, institutional support, ethical concerns, workload, and student-related challenges. These findings suggest that frequent AI utilization does not necessarily correspond to improved pass-fail performance. From a Development Education perspective, the study highlights faculty capability development, institutional capacity building, equitable AI integration, and sustainable educational innovation aligned with SDG 4. Consequently, a Results-Based Faculty AI-ICE Framework Training Plan was developed to address implementation barriers and strengthen responsible AI integration in resource-constrained educational contexts.

Keywords: *Development Education, AI-ICE, educational equity, faculty capability, institutional resilience, sustainable educational innovation*

Introduction:

The rapid advancement of artificial intelligence (AI) has transformed educational landscapes worldwide and has fundamentally altered the ways teaching and learning are designed, delivered, and assessed. In higher education, AI-powered technologies have increasingly been utilized to personalize instruction, facilitate adaptive learning, provide real-time feedback, and support evidence-based pedagogical decision-making. The emergence of generative artificial intelligence, in particular, has expanded the possibilities of instructional innovation by enabling the creation of instructional materials, learning resources, simulations, and interactive experiences that promote learner engagement and higher-order thinking. Consequently, AI is increasingly recognized not merely as a technological tool but as a cognitive and pedagogical partner capable of augmenting human intelligence and enhancing teaching and learning processes.

Within this evolving educational landscape, the Ideas, Connections, and Extensions (ICE) Framework has gained recognition as a pedagogical approach that guides learners from foundational understanding toward increasingly sophisticated forms of thinking and knowledge application. The framework conceptualizes learning as a developmental progression in which learners first acquire essential concepts and information (Ideas), subsequently establish meaningful relationships among concepts and prior knowledge (Connections), and eventually transfer and apply learning to novel and authentic contexts (Extensions). When integrated with generative artificial intelligence,

this pedagogical model evolves into the Artificial Intelligence-Ideas, Connections, and Extensions (AI-ICE) Framework, which positions AI as a cognitive partner that supports idea generation, conceptual integration, reflective inquiry, and the ethical utilization of AI-generated information (Diao, 2021; Doe & Smith, 2024).

The AI-ICE Framework possesses considerable potential for promoting meaningful and student-centered learning experiences. Generative AI technologies can produce summaries, study guides, examples, simulations, and instructional resources that educators and students may utilize to facilitate discussion, stimulate inquiry, and support deeper conceptual understanding. Likewise, AI-assisted tools enable learners to organize information, refine arguments, synthesize perspectives, and establish connections across disciplines. Through these processes, artificial intelligence extends beyond information delivery and functions as a catalyst for creativity, collaboration, critical thinking, and problem-solving. Such applications are consistent with contemporary conceptions of twenty-first-century teaching and learning, which emphasize learner agency, digital literacy, innovation, adaptability, and higher-order cognitive processes.

Existing literature indicates that the AI-ICE Framework contributes positively to learner motivation, creativity, adaptive thinking, and instructional innovation, particularly when learning experiences are intentionally aligned with the progression from Ideas to Connections and subsequently to Extensions (Hou & Wang, 2024; Okada et al., 2025; Tulsiani, 2024). Studies further suggest that AI-assisted environments facilitate personalized learning pathways and support meaningful engagement by encouraging learners to actively construct knowledge, interrogate ideas, and apply understanding within authentic contexts. These findings underscore the educational potential of artificial intelligence in promoting cognitive engagement and pedagogical transformation.

Despite these promising developments, the integration of artificial intelligence in Philippine higher education remains uneven and constrained by numerous contextual challenges. Local government-run colleges, particularly those operating within resource-constrained environments, frequently encounter difficulties associated with inadequate technological infrastructure, limited access to digital resources, outdated instructional materials, and insufficient opportunities for faculty development in educational technologies (Estrellado & Miranda, 2023; Sanchez, 2024). Such challenges limit educators' capacities to meaningfully integrate artificial intelligence into teaching practices and consequently restrict opportunities for students to benefit from innovative and cognitively engaging learning experiences. The persistence of these conditions raises concerns regarding educational equity and the widening digital divide between well-resourced and resource-constrained institutions.

Moreover, although interest in artificial intelligence in education has increased substantially, there remains a paucity of empirically validated and context-sensitive frameworks that guide the integration of AI within higher education institutions characterized by limited resources and varying levels of technological readiness (Zhan et al., 2024). Existing studies have predominantly focused on technologically advanced educational environments and have paid comparatively less attention to the applicability of AI-assisted pedagogical frameworks in contexts where resource limitations significantly influence instructional practices. Consequently, there remains insufficient empirical evidence regarding how structured frameworks such as AI-ICE can support cognitive processes, pedagogical innovation, and meaningful learning experiences within resource-constrained higher education settings.

The institutional setting matters to this inquiry. Lapu-Lapu City College, Mandaue City College, and Talisay City College operate in contexts where faculty access to instructional materials, digital resources, and professional learning can be limited. Evaluating faculty practices in these colleges provides a basis for examining the extent of AI-ICE utilization, its association with final examination performance, and the conditions educators encounter when they use AI in instruction.

From a Development Education perspective, however, the challenge of artificial intelligence integration extends beyond the adoption of emerging educational technologies. It encompasses the development of human capabilities, institutional capacity, educational equity, and sustainable systems that enable higher education institutions to respond meaningfully to technological and societal change. This perspective is particularly relevant to local government-run colleges operating in resource-constrained environments, where limitations in infrastructure, financial resources, technological access, faculty development opportunities, and institutional support may affect their capacity to participate fully in AI-supported educational innovation. Thus, the integration of artificial intelligence in these institutions constitutes not only a technological and pedagogical concern but also an issue of educational and institutional development.

Within this developmental context, faculty capability and institutional capacity are essential to meaningful AI integration. The availability of AI technologies alone does not ensure their effective educational utilization. Educators require appropriate technological knowledge, pedagogical competence, ethical awareness, and continuing professional development, while institutions require supportive policies, infrastructure, leadership, technical assistance, and governance mechanisms. This position is consistent with the Technology Acceptance Model, which emphasizes perceived usefulness and ease of use in technology adoption (Davis, 1989), and the TPACK Framework, which highlights the interaction of technological, pedagogical, and content knowledge in meaningful technology integration (Mishra & Koehler, 2006). Accordingly, developing faculty capability in AI integration may be viewed as part of the broader process of strengthening institutional capacity to respond to educational transformation.

The integration of AI also presents an important concern for educational equity and inclusive development. As previously established, differences in technological infrastructure, connectivity, access to digital resources, and faculty development opportunities characterize resource-constrained educational environments (Estrellado & Miranda, 2023; Sanchez, 2024). These conditions suggest that opportunities to participate in AI-supported education may not be equally available across institutions. AI should therefore not be assumed to reduce educational inequity by itself. Rather, equitable AI integration requires deliberate institutional efforts to strengthen access, faculty capability, technological support, and responsible implementation so that emerging educational technologies do not further widen existing disparities.

Furthermore, strengthening the capacity of higher education institutions to respond to emerging technologies may contribute to institutional resilience and sustainable educational innovation. In the context of this study, institutional resilience refers to the capacity of resource-constrained colleges to adapt to technological change while maintaining educational quality, inclusivity, ethical responsibility, and human-centered teaching. This developmental orientation is also consistent with the broader aspiration of Sustainable Development Goal 4, which promotes inclusive and equitable quality education and lifelong learning opportunities. Consequently, examining AI integration in local government-run colleges provides an opportunity to understand not only how educators utilize emerging technologies but also the human and institutional conditions necessary for meaningful, equitable, and sustainable educational innovation

The study contributes to Development Education by documenting barriers relevant to faculty capability, institutional capacity, educational equity, institutional resilience, and sustainable educational innovation. Its findings can inform instructional design, professional development, resource allocation, and responsible AI governance in local colleges. These institutional priorities are consistent with the emphasis of Sustainable Development Goal 4 on inclusive and equitable quality education and continuing opportunities for learning.

Literature Review

The ICE approach describes progression in learning from foundational Ideas to Connections among concepts and Extensions to new contexts. Fostaty Young and Wilson (2000) developed ICE as an approach to assessment and learning. Wood and Moss (2024) adapted this progression to examine student interactions with generative AI. In the present study, the framework was operationalized through four dimensions of faculty practice. Ideas covered brainstorming and problem-solving. Connections involved linking concepts to prior knowledge. Extensions involved applying learning to novel situations. The fourth dimension captured AI use in teaching and learning strategies, including personalization, instructional decisions, and evaluation.

Davis (1989) identified perceived usefulness and ease of use as central to technology acceptance. The Theory of Reasoned Action adds that attitudes and subjective norms shape intentions and behavior (Fishbein & Ajzen, 1975). These theories help explain faculty adoption. Constructivist learning theory situates knowledge construction in active engagement with prior understanding, while Cognitive Load Theory emphasizes the demands placed on working memory during learning (Garousi et al., 2026; Ibironke et al., 2026; Sweller, 1988). TPACK connects technology selection with disciplinary content and pedagogy. In their review of AI professional development, Dogan et al. (2025) emphasized preparing educators to use AI for instructional purposes alongside developing technical skills.

Asirit and Hua (2023) documented differences in AI readiness in Philippine higher education. Giray et al. (2024) reported barriers involving institutional resources and concerns about academic integrity. Evidence on

achievement also varies by outcome and study design. Bancoro (2024) reported no significant relationship between AI use and academic performance among Business Administration students. Cabuquin et al. (2024) found that students perceived ChatGPT as useful for generating research ideas and understanding concepts, while its perceived influence on overall academic performance was moderate. Together, these studies distinguish adoption and perceived usefulness from measured achievement. The present study addresses that gap by examining faculty-reported practices alongside institutional final examination pass rates and using faculty accounts to identify support needs.

Methodology

The study used an explanatory sequential mixed methods design. A descriptive-correlational strand profiled faculty, summarized AI-ICE use and student examination performance, and tested associations. Faculty responses to an open-ended question were analyzed after the quantitative results and integrated during interpretation.

The study involved 155 instructors purposively selected from a sampling frame of 265 full-time and part-time faculty across three local government-run colleges in Cebu. Table 1 shows the distribution by institution.
The sampling frame was derived from the official list of full-time and part-time faculty members provided by the Human Resource or Academic Affairs Offices of the participating college. Only those instructors who were actively teaching during the 2nd semester A.Y. 2024-2025 and had at least one year of experience were considered eligible for inclusion in the study.

An a priori GPower 3.1 analysis specified a two-tailed correlation, expected r = .30, α = .05, and power = .80. The dissertation reports a minimum sample size of 84.

Table 1

Respondents

Local Colleges in Cebu	Frequency (f)	Percentage (%)	Total
Lapu-Lapu City College	60	38.71	60
Mandaue City College	50	32.26	50
Talisay City College	45	29.03	45
Total	155	100.00	155

The instrument contained demographic items, a 20-item AI-ICE utilization scale with five items per dimension, and an open-ended question on implementation barriers. Experts reviewed the instrument, and the researcher assessed internal consistency using Cronbach's alpha after a pilot with instructors outside the main sample. The dissertation does not report the coefficients. Dimension scores were the means of their five frequency items. The overall utilization score averaged the four-dimension means. Tables 2 and 3 show the rating guide and interpretation bands. The companion supplement reproduces the questionnaire tables.

Table 2

Rating Scale and Descriptive Interpretation for the Extent of AI Tool Integration in Teaching Practices

Rating	Range	Verbal description	Qualitative description
5	Always	The AI is consistently used and integrated into practice.	The respondent consistently and extensively uses and integrate AI in their teaching.
4	Often	The AI is used regularly.	The respondent often and frequently uses AI in their teaching.
3	Sometimes	The AI is used occasionally or with some regularity.	The respondent sometime uses AI in their teaching.
2	Seldom	The AI is used infrequently.	The respondent seldom uses AI in their teaching.

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Rating	Range	Verbal description	Qualitative description
1	Never	The AI is not used.	The respondent never uses AI into their teaching.

Table 3

Interpretation of the Mean Scores for the Extent of Utilization of the AI-ICE Framework

Mean Range	Interpretation	Qualitative description
4.21 – 5.00	Very High Extent	The indicator is always manifested
3.41 – 4.20	High Extent	The indicator is often manifested
2.61 – 3.40	Moderate Extent	The indicator is sometimes manifested
1.81 – 2.60	Low Extent	The indicator is seldom manifested
1.00 – 1.80	Very Low Extent	The indicator is never manifested.

The participating colleges authorized data collection. Faculty gave informed consent and were informed of confidentiality, voluntary participation, and their right to withdraw. With institutional authorization, the researcher obtained aggregate final examination pass-fail records for the first semester of School Year 2025–2026. Only aggregate student data were used, consistent with the Data Privacy Act of 2012.

Frequency counts and percentages described the respondent profile. Weighted means and standard deviations summarized the four AI-ICE utilization dimensions. The reported examination results were grouped by percentage of students who passed. Pearson's product-moment correlation examined the direction and strength of the linear association between each AI-ICE dimension and the performance measure (Gravetter & Wallnau, 2020). The correlation significance test was two-tailed at $\alpha = .05$ (Field, 2018).

The open-ended responses were analyzed using Braun and Clarke's (2006) six-phase thematic analysis. The researcher familiarized themselves with the responses, coded them, grouped related codes, and reviewed, defined, and reported the themes. Coded extracts supported the interpretations and a coding matrix recorded the analysis. The strands were integrated in a joint display to contextualize the correlations and inform the proposed training plan.

Results

Respondent Profile

The largest age group was 40–49 years (35.5%), followed by 20–29 years (32.3%). The mean age was 37.02 years. Table 4 presents the full age distribution.

Table 4

Age of the Respondents

Age	Frequency	Percentage
20–29 years	50	32.3
30–39 years	33	21.3
40–49 years	55	35.5
50 years and above	17	11.0
Total	155	100.0
Mean Age	37.02 years	
Standard Deviation	10.29 years	

Women accounted for 61.9% of the sample and men for 38.1%. Table 5 shows the gender distribution.

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Table 5

Gender of the Respondents

Gender	Frequency	Percentage
Male	59	38.1
Female	96	61.9
Total	155	100.0

Just over half of the respondents had zero to five years of teaching experience (51.0%). Table 6 shows the distribution by experience.

Table 6

Years of Teaching Experience

Years of Teaching Experience	Frequency	Percentage
0–5 years	79	51.0
6–10 years	28	18.1
11–20 years	30	19.4
21 years and above	18	11.6
Total	155	100.0

Faculty members with master's degree units formed the largest educational attainment category (36.8%). Table 7 presents the full distribution.

Table 7

Educational Attainment

Educational Attainment	Frequency	Percentage
Bachelor's Degree	12	7.7
Master's Degree with Units	57	36.8
Full-fledged Master's Degree	32	20.6
Doctoral Degree with Units	22	14.2
Full-fledged Doctoral Degree	32	20.6
Total	155	100.0

Education, Arts, and Sciences accounted for 54.2% of the sample, followed by Business, Hospitality, and Tourism (34.8%) and Technology (11.0%). Table 8 presents the disciplinary distribution.

Table 8

Subject Area of Specialization

Subject Area of Specialization	Frequency	Percentage
Education, Arts, and Sciences	84	54.2
Business, Hospitality, and Tourism	54	34.8
Technology	17	11.0
Total	155	100.0

A total of 118 respondents (76.1%) reported prior participation in AI-related professional development. Table 9 shows the distribution of responses.

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Table 9

Participation in AI-Related Professional Development Programs

Participation in AI-Related Professional Development	Frequency	Percentage
Yes	118	76.1
No	37	23.9
Total	155	100.0

Extent of AI-ICE Utilization

Fostering Innovative Ideas was rated Often (M = 3.4297, SD = 0.9654). AI-assisted brainstorming received the highest item mean (3.6194). Project-based problem-solving received the lowest (3.1613). Table 10 presents the item-level results.

Table 10

Fostering Innovative Ideas

Indicators	Mean	SD	Description
I utilize AI tools to encourage students to generate original ideas and solutions.	3.5935	0.81142	Often
I integrate AI-driven brainstorming applications in classroom activities.	3.6194	0.98871	Often
I encourage students to use AI tools to explore multiple perspectives on a topic.	3.5161	0.98926	Often
I assign projects that require the use of AI tools for innovative problem-solving.	3.1613	0.96352	Sometimes
I provide feedback on students' use of AI tools to foster their creative processes.	3.2581	1.07413	Sometimes
Overall	3.4297	0.9654	Often

Legend: 5.00-4.21 Always; 4.20-3.41 Often; 3.40-2.61 Sometimes; 2.60-1.81 Seldom;1.80-1.00 Never

Building Meaningful Connections had the highest overall mean among the four dimensions (M = 3.5058, SD = 0.9558, Often). Linking new material to students' prior knowledge had the highest item mean (3.6710). Table 11 presents the results.

Table 11

Building Meaningful Connections

Indicators	Mean	SD	Description
I use AI platforms to help students relate new information to their existing knowledge.	3.6710	0.90532	Often
I implement AI-driven concept mapping tools to illustrate relationships between ideas.	3.4581	0.94139	Sometimes
I encourage students to use AI applications to draw parallels between different subjects.	3.3097	1.00368	Sometimes
I utilize AI analytics to identify and address gaps in students' understanding.	3.4968	1.04057	Often
I integrate AI tools that adapt content to students' learning paths, reinforcing connections.	3.5935	0.88785	Often
Overall	3.5058	0.9558	Often

Legend: 5.00-4.21 Always; 4.20-3.41 Often; 3.40-2.61 Sometimes; 2.60-1.81 Seldom;1.80-1.00 Never

Creating Cognitive Extensions had the lowest overall mean (M = 3.12516, SD = 0.988558, Sometimes). All five indicators were rated Sometimes. Projects requiring students to use AI to predict outcomes from data received the lowest mean (2.8065). Table 12 presents the results.

Table 12

Creating Cognitive Extensions

Indicators	Mean	SD	Description
I assign tasks that require students to apply AI tools in novel situations.	3.3871	0.87079	Sometimes
I encourage students to use AI simulations to explore hypothetical scenarios.	3.0387	0.97290	Sometimes
I facilitate projects where students use AI to predict outcomes based on data analysis.	2.8065	1.01991	Sometimes
I integrate AI applications that challenge students to synthesize information creatively.	3.3677	0.93988	Sometimes
I assess students' ability to transfer AI-assisted learning to real-world contexts.	3.0258	1.13931	Sometimes
Overall	3.12516	0.988558	Sometimes

Legend: 5.00-4.21 Always; 4.20-3.41 Often; 3.40-2.61 Sometimes; 2.60-1.81 Seldom;1.80-1.00 Never

Enhancing Teaching and Learning Strategies was rated Often (M = 3.4826, SD = 0.9763). Evaluating AI tools against learning outcomes received the highest item mean (3.6258), while engagement in AI-related professional development received the lowest (3.1742). Table 13 presents the results.

Table 13

Enhancing Teaching and Learning Strategies

Indicators	Mean	SD	Description
I incorporate AI tools to personalize learning experiences for students.	3.6194	0.87736	Often
I use AI analytics to inform instructional decisions and strategies.	3.5161	0.94219	Often
I engage in professional development to enhance my AI integration skills.	3.1742	1.13474	Sometimes
I collaborate with colleagues to share best practices in AI-enhanced teaching.	3.4774	1.02143	Often
I evaluate the effectiveness of AI tools in achieving learning outcomes.	3.6258	0.90560	Often
Overall	3.4826	0.9763	Often

Legend: 5.00-4.21 Always; 4.20-3.41 Often; 3.40-2.61 Sometimes; 2.60-1.81 Seldom;1.80-1.00 Never

Student Final Examination Performance

Table 14 presents the distribution of the 155 pass-rate observations. The observed rates fell between 98.0% and 100%. Seventy-eight observations (50.3%) recorded a 100% pass rate and 57 (36.8%) fell between 99.0% and 99.9%. The remaining 20 observations (12.9%) fell between 98.0% and 98.9%.

Table 14

Students' Academic Performance in Terms of Pass-Fail Status

Percentage of Students Who Passed	Frequency	Percentage
98.0%–98.9%	20	12.9
99.0%–99.9%	57	36.8
100%	78	50.3

Percentage of Students Who Passed	Frequency	Percentage
Total	155	100.0

Association Between AI-ICE Utilization and Examination Performance

Table 15 presents the four Pearson correlations. All coefficients were close to zero and all two-tailed p values exceeded .05. The study therefore failed to reject the null hypothesis for each dimension.

Table 15

Significant Relationship Between the Extent of Use of the AI-ICE Framework and Students' Academic Performance

AI-ICE Dimension	Pearson Correlation (r)	Sig. (2-tailed)	Decision	Interpretation
Fostering Innovative Ideas	0.024	0.765	Accept H_o	No Significant Relationship
Building Meaningful Connections	-0.064	0.428	Accept H_o	No Significant Relationship
Creating Cognitive Extensions	-0.027	0.736	Accept H_o	No Significant Relationship
Enhancing Teaching and Learning Strategies	0.014	0.866	Accept H_o	No Significant Relationship

The analysis of responses from 155 educators produced six themes. Tables 16 and 17 show how initial codes were grouped and reviewed. The companion supplement contains the full initial coding matrix.

Educators reported limited device availability, unreliable internet connectivity, and difficulty financing software and equipment. These constraints affected access for both educators and students.

R3 "Lisod kaayo ang access sa updated devices daghan pa gyud nga teachers naggamit og karaan nga laptops nga dili compatible sa AI platforms."

Educators described limited AI literacy, insufficient hands-on training, and a need for continuing professional learning. Respondents distinguished familiarity with basic functions from the ability to use AI for instructional purposes.

Participants cited limited administrative support, unclear rules on acceptable AI use, and gaps in technical and organizational assistance. They described a need for institutional systems to guide and sustain implementation.

Educators raised concerns about ethical use, output reliability, privacy, academic integrity, and the role of teacher judgment and human interaction in AI-assisted instruction.

Respondents reported that learning tools and redesigning lessons placed additional demands on their time. They also described hesitation among colleagues and the need for institutional support during the transition.

Educators described unequal student access and digital readiness, reliance on AI-generated answers, and difficulty maintaining academic integrity. They emphasized guidance on responsible student use.

Table 16

Emerging Themes

Initial Codes (Open Codes)	Category	Emerging Theme
Lack of digital infrastructure	Technological Infrastructure	Theme 1. Technological Infrastructure and Resource Constraints
Unstable internet connection	Technological Infrastructure	Theme 1
Slow internet speed	Technological Infrastructure	Theme 1
Poor Wi-Fi access	Technological Infrastructure	Theme 1
Limited access to updated devices	Technological Infrastructure	Theme 1

Initial Codes (Open Codes)	Category	Emerging Theme
Outdated computers	Technological Infrastructure	Theme 1
Lack of AI software	Technological Infrastructure	Theme 1
Insufficient ICT facilities	Technological Infrastructure	Theme 1
Limited technical support	Technological Infrastructure	Theme 1
Lack of maintenance personnel	Technological Infrastructure	Theme 1
Digital divide among students	Equity in Technology Access	Theme 1
Unequal access to devices	Equity in Technology Access	Theme 1
Financial limitations	Resource Availability	Theme 1
Limited school funding	Resource Availability	Theme 1
High cost of AI technologies	Resource Availability	Theme 1
Budget constraints	Resource Availability	Theme 1
Lack of AI training	Teacher Professional Development	Theme 2. Insufficient Teacher Competence and Professional Development
Limited AI literacy	Teacher Professional Development	Theme 2
Lack of AI knowledge	Teacher Professional Development	Theme 2
Insufficient workshops	Teacher Professional Development	Theme 2
Limited seminars	Teacher Professional Development	Theme 2
Lack of continuous training	Teacher Professional Development	Theme 2
Difficulty learning AI tools	Teacher Professional Development	Theme 2
Low teacher confidence	Teacher Professional Development	Theme 2
Limited digital competence	Teacher Professional Development	Theme 2
Lack of mentoring	Teacher Professional Development	Theme 2
Lack of administrative support	Organizational Support	Theme 3. Organizational and Institutional Support Deficiencies
Weak school leadership	Organizational Support	Theme 3
Unclear implementation guidelines	Organizational Support	Theme 3
Lack of institutional policies	Organizational Support	Theme 3
Poor communication	Organizational Support	Theme 3
Limited collaboration	Organizational Support	Theme 3
Weak implementation planning	Organizational Support	Theme 3
Lack of strategic direction	Organizational Support	Theme 3
Data privacy concerns	Ethical Concerns	Theme 4. Ethical, Trust, and Pedagogical Concerns
AI bias	Ethical Concerns	Theme 4

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Initial Codes (Open Codes)	Category	Emerging Theme
Fairness in AI assessment	Ethical Concerns	Theme 4
Trust issues	Ethical Concerns	Theme 4
Reliability of AI outputs	Ethical Concerns	Theme 4
Fear of misinformation	Ethical Concerns	Theme 4
Loss of teacher autonomy	Pedagogical Concerns	Theme 4
Reduced human interaction	Pedagogical Concerns	Theme 4
Overreliance on AI	Pedagogical Concerns	Theme 4
Time constraints	Workload Management	Theme 5. Increased Workload and Resistance to Change
Heavy workload	Workload Management	Theme 5
Teacher burnout	Workload Management	Theme 5
Lack of preparation time	Workload Management	Theme 5
Resistance to change	Change Management	Theme 5
Fear of innovation	Change Management	Theme 5
Low motivation	Change Management	Theme 5
Difficulty adapting	Change Management	Theme 5
Student misuse of AI	Student Challenges	Theme 6. Student-Related Challenges in AI Adoption
Academic dishonesty	Student Challenges	Theme 6
AI dependency	Student Challenges	Theme 6
Reduced critical thinking	Student Challenges	Theme 6
Student resistance	Student Challenges	Theme 6
Lack of student digital skills	Student Challenges	Theme 6
Unequal student access	Student Challenges	Theme 6
Low student engagement	Student Challenges	Theme 6

Table 17

Reviewing Themes

Preliminary Theme	Review Process	Final Decision	Justification
Technological Infrastructure and Resource Constraints	Responses concerning internet connectivity, digital devices, software availability, funding, and technical support consistently reflected institutional resource limitations.	Retained	The coded responses demonstrated strong internal consistency and clearly represented infrastructure-related barriers encountered by educators.

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Preliminary Theme	Review Process	Final Decision	Justification
Insufficient Teacher Competence and Professional Development	Codes relating to AI literacy, lack of training, limited digital competence, and insufficient workshops were reviewed and found to describe educators' preparedness rather than organizational issues.	Retained	The responses consistently highlighted the need for continuous professional development to support AI integration.
Organizational and Institutional Support Deficiencies	Administrative support, leadership commitment, implementation guidelines, institutional policies, and communication were examined together. Some codes initially placed under professional development were reassigned to this theme because they reflected institutional responsibilities rather than individual competencies.	Retained with refinement	The refined theme accurately captures the role of institutional leadership and governance in AI implementation.
Ethical, Trust, and Pedagogical Concerns	Codes involving data privacy, algorithmic bias, fairness, trustworthiness of AI, teacher autonomy, and reduced human interaction were reviewed together. These codes consistently reflected educators' concerns regarding responsible AI use.	Retained	The reviewed data showed that ethical and pedagogical issues formed a distinct dimension separate from technical or organizational barriers.
Increased Workload and Resistance to Change	Responses concerning workload, time limitations, burnout, adaptation difficulties, and resistance to innovation were reviewed. Initially, resistance was considered part of professional competence but was later recognized as a consequence of workload and organizational change.	Retained with refinement	The review confirmed that resistance stemmed primarily from workload pressures and change management rather than inadequate knowledge alone.
Student-Related Challenges in AI Adoption	Responses describing academic dishonesty, AI dependency, reduced critical thinking, unequal student access, and limited digital literacy were examined collectively.	Retained	These responses consistently focused on learner-related barriers that influence successful AI-ICE implementation, making the theme distinct from teacher-related concerns.

Integration of the Quantitative and Qualitative Findings

Table 18 brings the two strands together. Faculty reported regular AI-ICE use in several areas even while describing constraints on the depth, consistency, and sustainability of that use. Their accounts provide context for interpreting the utilization patterns and near-zero correlations. The study did not test the barriers as statistical explanations for the correlations.

Table 18

Joint Display of the Quantitative and Qualitative Findings

Quantitative Finding	Qualitative Finding	Meta-Inference
Frequent AI-ICE utilization	Limited AI literacy and professional development	Frequent utilization indicates that educators are already engaging with AI-assisted instructional practices; however, limitations in AI literacy and professional development suggest that frequency of use does not necessarily reflect depth or pedagogical quality of integration. Continuous faculty capability development is therefore necessary to strengthen meaningful AI-ICE implementation.
No significant relationship between AI-ICE utilization and pass-fail academic performance	Student-related challenges	AI-ICE utilization was not significantly associated with students' pass-fail academic performance. Challenges involving student readiness, responsible AI use, dependence on AI-generated content, and other learner-related conditions provide contextual explanations for why frequent utilization may not necessarily correspond with variations in pass-fail performance. Moreover, pass-fail performance may not fully capture the instructional and learning processes supported by AI-ICE.
Frequent utilization within resource-constrained educational contexts	Technological infrastructure and resource limitations	Educators' frequent utilization demonstrates that AI-assisted practices can occur even within resource-constrained educational contexts. However, limitations in connectivity, technological resources, and access to AI applications may affect the depth, consistency, and sustainability of implementation, indicating that utilization alone does not necessarily represent equitable or optimal AI integration.
Educators utilize AI-assisted instructional practices	Ethical and pedagogical concerns	The utilization of AI-assisted instructional practices occurs alongside concerns regarding academic integrity, data privacy, reliability of AI-generated information, and responsible use. Thus, meaningful AI-ICE implementation requires ethical safeguards and pedagogical judgment to ensure that AI complements rather than replaces human-centered teaching and learning.
Variation in AI-ICE implementation experiences	Limited organizational and institutional support	Differences in implementation experiences occur within varying levels of institutional support. The qualitative findings indicate that sustainable AI integration requires institutional leadership, appropriate policies, technical assistance, technological support, and continuing faculty development rather than relying solely on individual educators' initiative.

Quantitative Finding	Qualitative Finding	Meta-Inference
Frequent utilization alongside implementation difficulties	Increased workload and resistance to change	Frequent utilization does not eliminate the practical demands associated with AI integration. Increased workload, adaptation requirements, and resistance to technological change provide contextual evidence that faculty willingness and utilization alone may be insufficient for sustainable implementation without appropriate organizational support and manageable implementation structures.

The proposed plan addresses the implementation barriers identified in the qualitative strand and the practice areas identified in the utilization results. It covers AI literacy, AI-assisted instructional integration, innovative teaching and meaningful learning, AI-assisted assessment, collaborative professional learning, ethical and responsible AI utilization, and sustainable institutional implementation. Table 19 specifies the activities, responsible persons, timelines, resources, budget sources, expected outputs, success indicators, and means of verification. The plan is a proposed study output, and its indicators describe intended implementation targets.

Table 19
Results-Based Faculty AI-ICE Framework Training Plan

Areas of Concern	Objectives	Activities	Persons Responsible	Time Frame	Resources Needed	Budget Source	Expected Output	Success Indicator / KPI	Means of Verification
1. Limited AI literacy and professional development	Enhance faculty members' foundational knowledge of AI in Education, responsible AI use, and the AI-ICE Framework to address identified gaps in AI literacy and professional development.	Conduct orientation and seminar-workshop on AI in Education, AI literacy, AI ethics, responsible prompting, and the AI-ICE Framework; administer pretest and posttest.	College President, Research Director, ICT Office, External Resource Speakers	Week 1	Training venue, projector, internet connection, laptops, training manual, pretest-posttest instruments	Institutional Faculty Development Fund / CHED FDP	Faculty completing AI literacy and AI-ICE orientation with documented improvement in knowledge	At least 80% of participating faculty improve their posttest scores by at least 20% from their respective pretest scores; at least 90% complete the training.	Attendance sheets, individual pretest-posttest results, evaluation forms, certificates of participation

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Areas of Concern	Objectives	Activities	Persons Responsible	Time Frame	Resources Needed	Budget Source	Expected Output	Success Indicator / KPI	Means of Verification
2. Limited competence in integrating AI into teaching	Develop faculty competence in designing pedagogically appropriate AI-assisted instruction aligned with learning outcomes and the AI-ICE Framework.	Hands-on workshop on AI-assisted lesson planning, prompt engineering, classroom applications, instructional design, and alignment of AI tools with learning outcomes.	Dean, Program Chairs, Educational Technology Experts	Weeks 2–3	AI applications, laptops, instructional templates, internet access, evaluation rubric	College Faculty Development Budget	AI-ICE-aligned lesson plans and instructional materials	At least 90% of participating faculty develop one complete AI-ICE-aligned lesson plan; at least 80% of submitted plans obtain a rating of "Proficient" or higher based on the approved evaluation rubric.	Approved lesson plans, instructional materials, workshop outputs, scoring rubrics, facilitator evaluation

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Areas of Concern	Objectives	Activities	Persons Responsible	Time Frame	Resources Needed	Budget Source	Expected Output	Success Indicator / KPI	Means of Verification
3. Difficulty in promoting innovative thinking and meaningful learning through AI	Strengthen faculty capacity to design AI-assisted activities that foster innovative ideas, meaningful connections, authentic application, and learner-centered instruction.	Workshop on inquiry-based learning, project-based learning, brainstorming, concept mapping, authentic learning tasks, and AI-assisted activities structured around Ideas, Connections, and Extensions.	Educational Technology Experts, Faculty Facilitators, Program Chairs	Weeks 4–5	AI platforms, collaboration software, workshop modules, activity templates, evaluation rubrics	Institutional Research and Extension Fund	AI-ICE-aligned learning activities and instructional exemplars	At least 90% of participating faculty produce at least one AI-assisted learning activity demonstrating Ideas, Connections, and Extensions; at least 80% of outputs obtain a “Proficient” or higher rating based on the approved rubric.	Instructional outputs, peer-evaluation forms, facilitator rubrics, observation checklist

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Areas of Concern	Objectives	Activities	Persons Responsible	Time Frame	Resources Needed	Budget Source	Expected Output	Success Indicator / KPI	Means of Verification
4. Limited competence in AI-assisted assessment	Improve faculty competence in developing valid, authentic, and performance-based assessments with appropriate and responsible AI support.	Training-workshop on AI-assisted assessment design, rubrics, performance tasks, portfolios, formative assessment, verification of AI-generated assessment items, and alignment with learning outcomes.	Assessment Coordinator, Educational Technology Experts, Program Chairs	Week 6	Assessment templates, AI assessment tools, laptops, validation rubrics	Academic Affairs Office	AI-assisted assessment instruments and corresponding evaluation plans	At least 90% of participating faculty develop one AI-assisted assessment instrument; at least 80% of submitted instruments obtain a “Proficient” or higher rating for alignment, validity, appropriateness, and responsible AI use.	Assessment outputs, approved rubrics, facilitator evaluation reports, workshop documentation

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Areas of Concern	Objectives	Activities	Persons Responsible	Time Frame	Resources Needed	Budget Source	Expected Output	Success Indicator / KPI	Means of Verification
5. Limited institutional collaboration, mentoring, and organizational support	Establish collaborative professional-learning mechanisms that provide continuing faculty support for AI integration and reduce reliance on individual faculty initiative.	Establish Communities of Practice (CoP), peer mentoring, coaching sessions, interdisciplinary learning circles, and scheduled sharing of AI-ICE practices and implementation experiences.	College Administrators, Faculty Leaders, Research Director, Program Chairs	Weeks 7–8; continuing thereafter	Meeting venue, collaboration platform, mentoring templates, documentation materials	Institutional Faculty Development Program	Functional AI-ICE Community of Practice and faculty mentoring mechanism	At least 80% of participating faculty engage in at least two mentoring or CoP sessions during the initial implementation period; 100% of participating academic departments designate at least one AI-ICE faculty mentor or focal person.	Attendance records, meeting minutes, mentoring logs, designation records, documented best practices

Areas of Concern	Objectives	Activities	Persons Responsible	Time Frame	Resources Needed	Budget Source	Expected Output	Success Indicator / KPI	Means of Verification
6. Ethical, trust, and pedagogical concerns in AI utilization	Strengthen faculty competence in responsible, ethical, human-centered, and policy-compliant use of AI in teaching, learning, and assessment.	Seminar-workshop on AI ethics, academic integrity, copyright, plagiarism, data privacy, AI hallucinations and verification, responsible prompting, transparency, and institutional AI policies; conduct scenario-based assessment.	Legal Officer, ICT Office, Research Ethics Committee, Academic Affairs Office	Week 9	Policy manuals, AI ethics guidelines, case scenarios, assessment instruments, presentation materials	GAD Fund / Faculty Development Fund	Faculty ethical AI-use guide, completed scenario-based assessment, and documented policy acknowledgment	At least 90% of participating faculty obtain at least 80% in the post-training ethical AI scenario assessment; 100% of participants accomplish the institutional responsible-AI acknowledgment form.	Scenario-assessment results, policy acknowledgment forms, reflection outputs, attendance records, seminar evaluation

Areas of Concern	Objectives	Activities	Persons Responsible	Time Frame	Resources Needed	Budget Source	Expected Output	Success Indicator / KPI	Means of Verification
7. Need for sustainable and institutionally supported AI integration	Develop context-responsive institutional and departmental action plans that support the sustainable implementation of the AI-ICE Framework within resource-constrained educational contexts.	Workshop on action planning, resource prioritization, monitoring and evaluation, policy development, faculty support, and presentation of departmental AI-ICE integration plans.	College President, Vice President for Academic Affairs, Deans, Research Director, Program Chairs	Week 10	Planning templates, monitoring tools, evaluation instruments, policy references	Institutional Operational Budget	Departmental AI-ICE implementation plans consolidated into an institutional AI-ICE action plan	100% of participating academic departments prepare and submit an AI-ICE implementation plan; at least 80% of submitted plans satisfy the established criteria for objectives, activities, responsibilities, timeline, resources, ethical safeguards, and monitoring indicators.	Approved departmental action plans, institutional action plan, evaluation rubrics, monitoring reports, program evaluation results

Discussion

The respondents represented several disciplines and career stages. Prior participation in AI-related professional development was common, although regular engagement in professional development was rated Sometimes. These measures capture different aspects of professional learning. Their contrast, together with faculty requests for hands-on training, suggests a need for continuing support that links AI literacy with lesson design and assessment. The study did not test differences in AI-ICE use across demographic groups.

Building Meaningful Connections was the most frequently used dimension. Educators most often reported using AI to relate new material to prior knowledge, a practice consistent with meaningful learning (Getha-Eby et al., 2014; Novak, 2002). Creating Cognitive Extensions was the least frequently used dimension, suggesting a specific focus for faculty development in designing tasks involving transfer, simulation, and data-based prediction. These measures reflect faculty reports of instructional practice. Student cognition was outside the measurement scope.

Examination Performance

The four nonsignificant correlations are consistent with the absence of an association reported by Bancoro (2024) in a different higher education setting. The range of observed pass rates was narrow, from 98.0% to 100%, and half of the observations were at 100%. The restricted variability may have limited the ability of the performance measure to differentiate between levels of AI-ICE use. Final examination pass rates also capture a narrower outcome than the engagement measured by Hmoud et al. (2025) or the creative thinking and transfer emphasized in AI-ICE.

Implementation and Development Education

Faculty reported unreliable connectivity, uneven device access, gaps in professional learning, unclear guidance, and added work when redesigning instruction. They also raised concerns about academic integrity, privacy, and students' readiness to evaluate AI-generated content. The Philippine findings of Asirit and Hua (2023) and Giray et al. (2024) similarly highlight readiness and infrastructure. These conditions contextualize the correlations. Their effects on examination performance were outside the analysis.

The proposed training plan pairs AI literacy and discipline-specific instruction with responsible-use policies, mentoring, technical support, and monitoring. From a Development Education perspective, this approach treats equitable access, faculty capability, and institutional capacity as interconnected requirements for sustaining AI-supported instruction.

Conclusion

Faculty in the three participating colleges reported frequent AI-ICE utilization in Fostering Innovative Ideas, Building Meaningful Connections, and Enhancing Teaching and Learning Strategies. Creating Cognitive Extensions was used less frequently. None of the four dimensions was significantly associated with students' final examination pass-rate measure. Faculty accounts identified technological, institutional, pedagogical, ethical, workload, and learner-related barriers that help explain the conditions in which these practices occurred.

Limitations

The study was confined to purposively selected faculty from three local government-run colleges in Cebu. Utilization was faculty-reported, and the examination indicator was based on aggregated pass-fail records for one semester with restricted variability. The design examined associations and faculty experiences. It did not directly measure students' cognitive processes or the developmental constructs of educational equity, faculty capability, and institutional resilience.

College leaders, academic units, and technology offices can use the proposed Results-Based Faculty AI-ICE Framework Training Plan to coordinate professional learning, mentoring, infrastructure, technical assistance, and institutional guidance on responsible AI use. The dissertation also recommends supporting students' AI literacy, academic integrity, and independent judgment. Future research can examine critical thinking, creativity, engagement, self-regulated learning, and digital competence directly, and use longitudinal, experimental, or multi-institutional designs to investigate outcomes over time.

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