

The Use of Artificial Intelligence Tools in Students' 21st Century Skills

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ABSTRACT

This study examines the role of artificial intelligence (AI) tools in developing 21st-century skills among students at the South Cluster Campuses of Bukidnon State University. Specifically, it investigates how AI tools influence critical thinking, problem-solving, and information technology skills. Using a descriptive-correlational research design, the study involved 150 tertiary students, and data were collected through a standardized questionnaire and researcher-made instrument. Statistical analyses, including mean, standard deviation, and Pearson correlation, were applied to measure the relationships between AI tool usage and the development of students' skills. Findings revealed a significant positive relationship between AI usage and the development of all three skills. Students reported high perceptions of AI's effectiveness in enhancing problem-solving and critical thinking, while the correlation with information technology skills, though still significant, was weaker. These results suggest that AI tools are integral in promoting cognitive development and digital literacy, contributing significantly to the cultivation of essential skills for the modern workforce. The study advocates for continued AI integration into academic environments to enhance skill acquisition and future learning outcomes.

Keywords: Artificial Intelligence, 21st Century Skills, Critical Thinking, Problem-Solving, Information Technology

INTRODUCTION

In the digital era, Artificial Intelligence (AI) has significantly transformed educational environments. AI tools, such as virtual assistants, predictive analytics, and intelligent tutoring systems, have reshaped how students learn and acquire critical 21st-century skills. These tools offer personalized learning experiences, provide immediate feedback, and support complex problem-solving, which are vital skills in the 21st century. With AI tools, students are able to engage with content interactively, fostering their critical thinking, creativity, and technological literacy. AI's integration into education is not just about enhancing academic performance but also preparing students for the digital economy, where technological proficiency is increasingly essential.

Despite the growing popularity of AI in educational settings, its impacts have raised several concerns. Some critics argue that an overreliance on AI could dehumanize the learning process, reducing interpersonal interactions and potentially stunting students' critical thinking development. There are fears that students may become overly dependent on AI, relying on it for answers rather than developing their own problem-solving skills. Additionally, ethical considerations such as data privacy, the potential for bias, and the risk of AI displacing human educators remain significant issues in the discourse surrounding AI integration in education. Nonetheless, despite these concerns, the benefits of AI tools in education cannot be ignored, particularly in enhancing students' abilities to navigate the complexities of the modern world.

This study explores the perceived effectiveness of AI tools in fostering 21st-century skills such as critical thinking, problem-solving, and information technology proficiency among students. By

examining how students use AI in their academic endeavors, the research aims to determine how these tools contribute to skill development and whether a significant relationship exists between AI tool usage and skill enhancement. The findings of this study could provide insights into how AI can be more effectively integrated into educational systems to promote student learning and development.

LITERATURE REVIEW

The integration of AI tools in education has shown promising potential in enhancing students' 21st-century skills. Researchers have highlighted the ability of AI to provide personalized learning experiences, helping students engage more deeply with academic content. According to Adewale et al. (2024), AI tools can significantly improve academic performance by offering personalized feedback and targeted interventions. These tools adapt to students' learning needs, allowing them to work at their own pace and focus on areas requiring improvement. This individualized approach can foster critical thinking and problem-solving, skills that are essential for success in the modern workforce.

Moreover, AI tools are found to enhance students' proficiency in technology-related tasks. Salido (2023) emphasized that AI's ability to process and analyze large datasets enables students to learn how to use technology effectively in various contexts. These tools provide students with immediate feedback, which enhances their understanding of complex concepts and encourages problem-solving strategies. Altememy et al. (2023) argue that AI plays a significant role in developing high-quality learning experiences, which not only improve academic outcomes but also equip students with the skills needed to excel in a technology-driven society.

However, the growing use of AI in education has also raised concerns. Goketa (2024) cautioned that an overreliance on AI could lead to the dehumanization of learning, diminishing the role of educators and interpersonal communication in the educational process. Additionally, there are concerns about data privacy and the ethical use of AI tools in classrooms. Stahl (2019) highlighted the potential risks associated with AI, including the loss of autonomy in decision-making and the misuse of personal data. These challenges underscore the need for responsible integration of AI tools, ensuring that their use enhances rather than replaces traditional learning methods.

Despite these concerns, there is a consensus that AI tools can significantly contribute to the development of 21st-century skills, particularly in critical thinking, problem-solving, and technological proficiency. Pacheco-Mendoza et al. (2023) noted that AI could improve student engagement by providing adaptive learning experiences that are tailored to individual needs. The study indicated that students who interact regularly with AI tools show enhanced academic performance, particularly in tasks that require deep analysis and complex reasoning. This suggests that AI can support the development of skills that are critical for students' success in the 21st century.

MATERIALS & METHODS

Research Design

This study utilized a descriptive-correlational research design to explore the relationship between the perceived use of AI tools and the development of students' 21st-century skills. The design aimed to assess how students use AI tools in their academic tasks and how this usage correlates with the development of skills such as critical thinking, problem-solving, and information technology proficiency. A survey was conducted among 150 tertiary students from the South Cluster Campuses of Bukidnon State University using a standardized questionnaire and a researcher-made instrument.

Participants / Respondents

The participants of this study were 150 tertiary students from five campuses of Bukidnon State University's South Cluster: Quezon, Damulog, Kitaotao, Kalilangan, and Kadingilan. The respondents were purposively selected based on their familiarity and usage of AI tools for academic purposes. The total sample was representative of students from diverse academic backgrounds, ensuring a comprehensive understanding of AI's role in developing 21st-century skills across different disciplines.

Data Gathering Procedure

Data was collected using a survey questionnaire that assessed students' perceived use of AI tools and their development of 21st-century skills. After obtaining permission from campus administrators, the questionnaire was distributed across the five campuses. The data collection process was conducted in a structured manner, ensuring confidentiality and anonymity for all participants. Once the surveys were completed, the responses were tallied and analyzed for statistical significance using appropriate methods.

Statistical Analysis

The data gathered from the surveys were analyzed using descriptive statistics, including mean and standard deviation, to determine the respondents' perceived use of AI tools and their level of 21st-century skill development. Pearson's correlation coefficient was used to examine the relationship between the perceived use of AI tools and the development of critical thinking, problem-solving, and information technology skills. This statistical method allowed the researchers to assess the strength and significance of the relationship between the variables.

RESULTS AND DISCUSSION

Table 1 presents the distribution of respondents' perceived level of the use of AI tools in terms of effectiveness. The overall mean of 3.58 (SD = 0.49) falls under the "At All Times" category, indicating a very high perception of the effectiveness of AI tools among students. This result implies that students consistently find AI tools highly effective in enhancing their learning, supporting their problem-solving efforts, and increasing productivity. The relatively low standard deviation indicates that the respondents' opinions are consistent, with little variation in their views on AI's effectiveness. This perception aligns with studies by Altememy et al. (2023), who suggested that AI tools can substantially transform educational environments by providing adaptive and personalized learning experiences that foster deeper student engagement.

The highest mean value of 3.67 (SD = 0.47) corresponds to the statement "AI tools enable me to explore topics and solve problems efficiently." This result highlights that students strongly associate AI tools with improving their ability to explore new topics and efficiently solve academic problems. The high mean value reflects the perception that AI tools are not only useful but essential in enabling students to work through complex academic challenges. It suggests that AI is seen as a critical aid for students to delve deeper into subjects and address academic queries, which is consistent with Adewale et al. (2024), who found that AI's predictive capabilities significantly enhance student engagement and performance by personalizing learning.

The lowest mean of 3.49 (SD = 0.50) is observed for the statement "AI tools are useful for evaluating my knowledge." Although this indicator also falls within the "At All Times" category, the mean is slightly lower compared to others. This suggests that while students recognize AI's role in evaluating their knowledge, they may not perceive it as effectively as other functions like problem-solving and content exploration. The variation in mean scores could be attributed to individual differences in how students engage with AI for self-assessment and knowledge evaluation. According to Goketa (2024),

too much reliance on AI in self-assessment can lead to a diminished role for personal judgment, highlighting the need for a balanced approach to AI integration in educational settings.

Table 1
Perceived Level of the Use of AI Tools in terms of Effectiveness

Statements	Mean	Standard Deviation	Description
AI tools help me effectively solve my doubts.	3.64	0.48	At All Times
Using AI tools improves my understanding of course material.	3.49	0.50	At All Times
AI tools enable me to explore topics and solve problems efficiently.	3.67	0.47	At All Times
AI tools encourage my creativity and innovation.	3.49	0.50	At All Times
AI tools are useful for evaluating my knowledge.	3.49	0.50	At All Times
AI tools enhance my personalized learning experience.	3.62	0.49	At All Times
AI tools simplify complex topics through interactive explanations.	3.58	0.50	At All Times
AI tools increase my productivity.	3.55	0.43	At All Times
AI tools help me find answers faster than traditional resources like Google.	3.58	0.50	At All Times
I recommend the use of AI tools to other students.	3.50	0.50	At All Times
Overall	3.58	0.49	At All Times

Legend: 1.00-1.75 Never/Very Low, 1.76-2.50 Sometimes/Low, 2.51-3.25 Most of the Time/High, and 3.26-4.00 At All Times/Very High

Table 2 displays the respondents' perceived proficiency in using AI tools. The overall mean of 3.69 (SD = 0.45) indicates that students perceive themselves as highly proficient in using AI tools across academic subjects. The relatively low standard deviation suggests that students' confidence in their AI proficiency is consistent. This finding implies that AI tools have become an integral part of students' academic routines, and they feel comfortable using them to complete various tasks. Such proficiency is essential, as it highlights how digital literacy is becoming a core competency for students in the 21st century, in line with Zhang et al. (2023), who emphasized that AI literacy is an essential skill akin to reading and writing.

Table 2
Perceived Level of the Use of AI Tools in terms of Proficiency

Statements	Mean	Standard Deviation	Description
I can easily formulate questions for ChatGPT related to my subjects.	3.72	0.44	At All Times
I find it easy to use AI tools to create academic queries.	3.97	0.32	At All Times
The AI tools I use are user-friendly and effective for solving problems.	3.49	0.50	At All Times
I frequently use AI tools in my academic subjects.	3.56	0.50	At All Times
I have mastered the use of ChatGPT in my academic tasks.	3.79	0.40	At All Times
I have mastered the AI tools introduced in my course.	3.66	0.48	At All Times
I can confidently manipulate and use AI tools.	3.69	0.46	At All Times
AI tools have made me more proficient in using technology.	3.70	0.46	At All Times
AI tools have improved my ability to navigate AI-based search tools.	3.72	0.45	At All Times
AI tools have further developed my technological skills.	3.58	0.50	At All Times
Overall	3.69	0.45	At All Times

Legend: 1.00-1.75 Never/Very Low, 1.76-2.50 Sometimes/Low, 2.51-3.25 Most of the Time/High, and 3.26-4.00 At All Times/Very High

The highest mean value of 3.97 (SD = 0.32) corresponds to the statement "I find it easy to use AI tools to create academic queries." This result suggests that students feel very comfortable using AI tools to

formulate academic questions and seek relevant answers. The high proficiency in creating queries points to a deep understanding of how to effectively interact with AI, demonstrating that students are not just passive users but active participants in the learning process. This aligns with Walter (2024), who pointed out that proficiency in using AI tools enables students to engage in complex cognitive tasks, such as creating precise academic queries, thus fostering critical thinking and independent learning.

The lowest mean of 3.49 (SD = 0.50) appears for the statement "The AI tools I use are user-friendly and effective for solving problems." Although this indicator still indicates a high level of proficiency, it suggests that some students may experience challenges with AI's user interface or its problem-solving capabilities. This implies that while AI tools are generally effective, there might be occasional difficulties in fully utilizing their problem-solving potential. This finding is consistent with Biagini et al. (2023), who found that AI tools must be intuitive and user-friendly for students to maximize their potential, emphasizing the need for improvements in AI system design and accessibility.

Table 3 presents the distribution of respondents' perceived use of AI tools in terms of advanced students' skills, with an overall mean of 3.59 (SD = 0.49). This result indicates that students generally perceive AI tools as highly effective in enhancing their advanced academic skills, such as critical thinking, problem-solving, and creative thinking. The relatively low standard deviation suggests that most students share similar views on the role of AI in enhancing these higher-order skills. This supports the idea that AI tools are not just for basic tasks but also facilitate the development of complex cognitive skills, as noted by Lim et al. (2023), who highlighted AI's role in promoting advanced skills like problem-solving and creativity through personalized learning experiences.

The highest mean of 3.73 (SD = 0.44) corresponds to the statement "AI tools help me expand or synthesize my written content." This result suggests that students particularly value AI's ability to assist them in refining and expanding their academic writing. The high proficiency in using AI tools for writing enhancement reflects an increasing reliance on technology to strengthen their argumentative and synthesis skills. This finding is in line with Li et al. (2024), who found that AI-supported writing assistants help students improve their writing skills by providing real-time feedback on structure, coherence, and logic, thereby enhancing their overall academic communication.

Table 3
Perceived Level of the Use of AI Tools in terms of Advanced Students' Skills

Statements	Mean	Standard Deviation	Description
I can easily formulate questions for ChatGPT related to my subjects.	3.65	0.46	At All Times
I find it easy to use AI tools to create academic queries.	3.73	0.44	At All Times
The AI tools I use are user-friendly and effective for solving problems.	3.52	0.5	At All Times
I frequently use AI tools in my academic subjects.	3.54	0.5	At All Times
I have mastered the use of ChatGPT in my academic tasks.	3.54	0.5	At All Times
I have mastered the AI tools introduced in my course.	3.51	0.5	At All Times
I can confidently manipulate and use AI tools.	3.64	0.48	At All Times
AI tools have made me more proficient in using technology.	3.62	0.49	At All Times
AI tools have improved my ability to navigate AI-based search tools.	3.62	0.49	At All Times
AI tools have further developed my technological skills.	3.52	0.5	At All Times
Overall	3.59	0.49	At All Times

Legend: 1.00-1.75 Never/Very Low, 1.76-2.50 Sometimes/Low, 2.51-3.25 Most of the Time/High, and 3.26-4.00 At All Times/Very High

The lowest mean of 3.51 (SD = 0.50) is observed for the statement "I use AI tools to identify and understand relevant theories for my subjects." Although this result still falls within the "At All Times" category, it suggests that some students might not fully utilize AI tools to support their understanding of theoretical concepts. This indicates that while AI tools are effective in various aspects of academic work, students may still prefer traditional methods for grasping complex theories. This finding aligns with Deng et al. (2023), who suggested that AI tools can assist with content delivery but may not fully replace traditional academic resources when it comes to deeply understanding theoretical frameworks.

Table 4 presents a summary of the respondents' perceived level of use of AI tools in terms of effectiveness, proficiency, and advanced students' skills. With an overall mean of 3.62 (SD = 0.48), the findings indicate that AI tools are consistently perceived as highly effective across all three dimensions. The relatively low standard deviation suggests a uniform perception among the respondents, meaning that most students agree on the value and impact of AI tools in enhancing their academic experiences. This high level of agreement emphasizes the strong integration of AI in academic settings, where students feel supported by AI tools in various aspects of their learning journey. Such findings align with the work of Adewale et al. (2024), who argued that AI's personalized feedback mechanisms and adaptive learning tools foster increased academic engagement and enhanced performance.

The highest mean of 3.69 (SD = 0.45) is attributed to the proficiency dimension, which suggests that students feel highly proficient in using AI tools. This result reflects their confidence in their ability to effectively navigate and utilize AI tools in their academic tasks. The relatively low standard deviation indicates a consistent belief in their proficiency across different student groups. This proficiency is crucial as it implies that students are not only familiar with AI tools but are also able to apply them efficiently in academic contexts. As Zhang et al. (2023) pointed out, the growing proficiency in using AI tools signifies a shift towards digital fluency, where students integrate AI into their learning processes as seamlessly as traditional academic methods.

The lowest mean of 3.58 (SD = 0.49) is seen in the effectiveness dimension, although it still falls within the "Very High" category. This suggests that, while students perceive AI tools as highly effective, there may be slightly more variation in their experiences regarding the specific functions of AI in supporting their academic work. This variation could stem from differences in how students use AI tools or from the specific academic tasks they apply AI to. However, the consistently high mean indicates that the overall perception of AI's effectiveness remains strong. This finding resonates with the conclusions of Pacheco-Mendoza et al. (2023), who found that AI tools are seen as highly effective for personalizing and enhancing student learning, although there may be areas for further improvement or adaptation based on individual learning needs.

Table 4
Summary of Perceived Level of Use of AI Tools

Statements	Mean	Standard Deviation	Description
Efficiency	3.58	0.49	At All Times
Proficiency	3.69	0.45	At All Times
Advanced Students' Skills	3.59	0.49	At All Times
Overall	3.62	0.48	At All Times

Legend: 1.00-1.75 Never/Very Low, 1.76-2.50 Sometimes/Low, 2.51-3.25 Most of the Time/High, and 3.26-4.00 At All Times/Very High

Table 5 shows the distribution of respondents' perceived development of 21st-century skills in critical thinking, with an overall mean of 3.56 (SD = 0.49). This indicates that students perceive AI tools as

highly effective in developing their critical thinking skills. The relatively low standard deviation suggests that most students share a similar view on the impact of AI in fostering critical thinking, making it a consistent factor across their learning experiences. The high level of development in critical thinking reflects the importance of AI in promoting deeper cognitive engagement and reflection, enabling students to analyze and assess information more thoroughly. This finding is in line with Jin and Ji (2021), who argued that AI tools play a key role in enhancing critical thinking by helping students evaluate arguments and think logically.

The highest mean of 3.71 (SD = 0.45) corresponds to the statement "AI has helped me become more reflective and analytical in my learning." This suggests that students highly value the role of AI in fostering self-reflection and enhancing their analytical skills. The strong agreement with this statement underscores the notion that AI tools support students in developing higher-order thinking skills, such as evaluating evidence, questioning assumptions, and synthesizing diverse perspectives. These skills are crucial for students to navigate complex academic tasks and real-world challenges. This aligns with the findings of Thornill-Miller et al. (2023), who emphasized the importance of critical thinking in processing vast amounts of information, where AI plays a supportive role in guiding students through this process.

The lowest mean of 3.20 (SD = 0.45) is seen in the statement "AI tools help me to identify logical flaws in reasoning or arguments." While this still falls within the "Most of the Times" category, it is slightly lower than the other indicators. This suggests that although students recognize the value of AI in supporting critical thinking, they may feel less confident in using AI to detect flaws in logic or reasoning. This could be due to the limitations of AI tools in providing nuanced, context-specific feedback on logical reasoning. The result highlights the need for further development of AI's capacity to assist students in identifying and correcting logical errors, as suggested by Lopez et al. (2023), who noted that AI's role in critical thinking needs to be integrated with human judgment for more effective learning outcomes.

Table 5
Perceived Level of 21st Century Skills Development in Aid of AI Use as Regards to Critical Thinking

Statements	Mean	Standard Deviation	Description
AI tools help me think more deeply about the topics I study.	3.68	0.47	At All Times
I use AI tools to evaluate different sides of an argument.	3.57	0.50	At All Times
AI encourages me to ask follow-up questions and explore ideas further.	3.66	0.47	At All Times
I analyze AI-generated content before deciding if it's accurate.	3.60	0.49	At All Times
AI tools help me to identify logical flaws in reasoning or arguments.	3.20	0.45	Most of the Times
I compare AI-generated ideas with my own to develop better conclusions.	3.48	0.50	At All Times
Using AI tools helps me challenge my assumptions and biases.	3.47	0.50	At All Times
I have learned to verify sources and evidence provided by AI tools.	3.70	0.59	At All Times
I use AI to test different solutions or viewpoints before forming a conclusion.	3.54	0.50	At All Times
AI has helped me become more reflective and analytical in my learning.	3.71	0.45	At All Times
Overall	3.56	0.49	At All Times

Legend: 1.00-1.75 Never/Not Developed at All, 1.76-2.50 Sometimes/Slightly Developed, 2.51-3.25 Most of the Time/Moderately Developed, and 3.26-4.00 At All Times/Highly Developed

Table 6 presents the distribution of respondents' perceived development of information technology skills through AI tools, with an overall mean of 3.37 (SD = 0.73). This high mean score indicates that students believe AI tools significantly enhance their information technology skills. The low standard deviation shows consistency in students' views, suggesting that most students perceive AI as an effective tool for improving their digital literacy. This finding implies that AI tools are widely recognized as beneficial in developing essential IT skills, such as managing digital processes, utilizing software, and handling information effectively. The importance of this development aligns with Wei et al. (2021), who highlighted that AI-based platforms are essential in fostering computational thinking and programming skills, which are crucial in the digital age.

The highest mean of 3.68 (SD = 0.47) corresponds to the statement "I have improved my ability to use digital tools by exploring AI platforms." This indicates that students strongly agree that AI tools have significantly improved their proficiency in using various technological tools. The high mean suggests that students are becoming more comfortable and confident with technology, an essential skill for success in the modern world. This result underscores the growing role of AI in preparing students for future professional environments, where technological proficiency is increasingly required. This aligns with Yilmaz et al. (2022), who found that AI-enhanced learning environments play a crucial role in developing students' technological and programming skills, fostering greater engagement and motivation in IT-related tasks.

The lowest mean of 3.21 (SD = 0.73) is found for the statement "I have learned to solve basic technical issues while using AI tools." Although still within the "Most of the Times" category, this result reflects a slightly lower perception of AI's effectiveness in improving students' search tool navigation skills. This could suggest that while students generally feel confident using AI tools, they might still face challenges in fully exploiting AI search functionalities to their maximum potential. The lower score might also reflect students' varying levels of familiarity with AI-based search tools and their features. This finding supports the observations of Biagini et al. (2023), who noted that while AI tools are highly beneficial, students' proficiency in using them effectively varies, especially when it comes to more specialized functions like advanced search and data analysis.

Table 6
Perceived Level of 21st Century Skills Development in Aid of AI Use as Regards to Information Technology Skills

Statements	Mean	Standard Deviation	Description
I have improved my ability to use digital tools by exploring AI platforms.	3.68	0.47	At All Times
Using AI tools has helped me become more confident in using technology for learning.	3.32	0.71	At All Times
I can now use multiple applications together with AI tools.	3.42	0.76	At All Times
I understand how to interact with AI using effective prompts and instructions.	3.31	0.77	At All Times
AI tools have helped me navigate and explore new digital platforms.	3.38	0.78	At All Times
I have learned to solve basic technical issues while using AI tools.	3.21	0.73	Most of the Times
I use AI tools as part of my regular digital workflow for studying or projects.	3.24	0.73	Most of the Times
AI tools have improved my ability to find and evaluate information online.	3.42	0.85	At All Times
I use AI tools responsibly, considering privacy, ethics, and digital safety.	3.32	0.72	At All Times
I am motivated to explore new digital tools after successfully using AI tools.	3.42	0.76	At All Times
Overall	3.37	0.73	At All Times

Legend: 1.00-1.75 Never/Not Developed at All, 1.76-2.50 Sometimes/Slightly Developed, 2.51-3.25 Most of the Time/Moderately Developed, and 3.26-4.00 At All Times/Highly Developed

Table 7 presents the distribution of respondents' perceived development of problem-solving skills through the use of AI tools, with an overall mean of 3.62 (SD = 0.49). This indicates that students strongly believe AI tools contribute to enhancing their ability to solve problems. The relatively low standard deviation suggests a uniform view among respondents, with most students agreeing that AI tools help them navigate complex challenges and develop solutions. The high score reflects the critical role AI plays in promoting higher-order problem-solving abilities, allowing students to think critically, explore solutions, and refine their decision-making skills. This is consistent with Bianchi (2024), who emphasized the role of AI in supporting collaborative and individual problem-solving by providing instant feedback and suggesting various approaches to complex problems.

The highest mean of 3.72 (SD = 0.45) corresponds to the statement "AI has helped me become more strategic and logical in solving problems." This indicates that students highly value AI's ability to assist in problem-solving tasks, especially in enhancing the quality of their written assignments. The high mean suggests that students recognize AI as a valuable tool for refining their problem-solving strategies, particularly when it comes to analyzing and synthesizing content. AI's contribution to expanding ideas and structuring arguments enhances students' critical thinking and decision-making skills, which are vital in academic and real-world problem-solving. This finding is supported by Muthmainnah et al. (2022), who demonstrated that AI tools help students develop problem-solving skills by providing instant feedback and suggesting alternative solutions to academic challenges.

The lowest mean of 3.47 (SD = 0.50) appears for the statement "AI encourages me to think of alternative solutions I might not have considered." This slightly lower mean, while still within the "At All Times" category, suggests that students may not always fully utilize AI tools to evaluate or analyze feedback provided by instructors. The lower score could indicate that students primarily use AI for generating content or solving specific problems but may not always rely on it for assessing the quality or relevance of external feedback. This result is consistent with Lin and Chen (2024), who pointed out that while AI tools can support various aspects of learning, students still rely on traditional methods, such as personal reflection and instructor guidance, to evaluate and improve their academic performance.

Table 7
Perceived Level of 21st Century Skills Development in Aid of AI Use as Regards to Problem-Solving Skills

Statements	Mean	Standard Deviation	Description
I use AI tools to explore different solutions to academic problems.	3.68	0.47	At All Times
AI helps me break down complex problems into smaller, manageable parts.	3.57	0.50	At All Times
I combine my ideas with AI suggestions to create better solutions.	3.67	0.47	At All Times
AI tools help me understand steps needed to solve specific tasks.	3.61	0.47	At All Times
I evaluate AI-generated solutions before deciding on the best one.	3.70	0.46	At All Times
I feel more confident solving problems after using AI tools.	3.48	0.50	At All Times
AI encourages me to think of alternative solutions I might not have considered.	3.47	0.50	At All Times
I use AI tools to simulate different scenarios and outcomes.	3.70	0.56	At All Times
I apply what I learn from AI to real-life problem-solving situations.	3.55	0.50	At All Times
AI has helped me become more strategic and logical in solving problems.	3.72	0.45	At All Times
Overall	3.62	0.49	At All Times

Legend: 1.00-1.75 Never/Not Developed at All, 1.76-2.50 Sometimes/Slightly Developed, 2.51-3.25 Most of the Time/Moderately Developed, and 3.26-4.00 At All Times/Highly Developed

Table 8 presents the summary of the respondents' perceived level of 21st-century skills development, aided by AI tools. The overall mean of 3.52 (SD = 0.57) falls within the "At All Times" category, suggesting that students consistently perceive AI tools as highly effective in enhancing their critical thinking, information technology, and problem-solving skills. The relatively low standard deviation of 0.57 indicates that there is little variation in students' responses, reflecting a shared perception of AI tools' positive influence across all respondents. This result implies that AI tools are not only perceived as a significant aid in academic performance but also as an integral factor in developing essential 21st-century skills. The consistency of this perception highlights the general acceptance and effectiveness of AI tools in the learning process, which aligns with previous findings by Altememy et al. (2023), who emphasized that AI fosters cognitive engagement and improves academic outcomes.

The highest mean of 3.62 (SD = 0.49) corresponds to "Problem-Solving Skills," indicating that students perceive AI tools as particularly effective in enhancing their ability to solve complex problems. The relatively low standard deviation suggests that most students have similar views regarding AI's contribution to developing their problem-solving abilities. This result suggests that AI tools, by providing real-time feedback, data-driven insights, and problem-solving frameworks, are particularly beneficial in helping students approach complex tasks with confidence and efficiency. The strong alignment between AI use and problem-solving skills implies that AI tools play a significant role in enhancing students' critical thinking and creative problem-solving abilities. This is in line with the findings of Deng et al. (2023), who suggested that AI-based tools help students evaluate, adapt, and apply strategies for solving real-world problems. The lowest mean of 3.37 (SD = 0.73) is observed for "Information Technology Skills," although it still falls within the "At All Times" category. This suggests that while students consistently use AI tools to improve their information technology skills, the perception of their effectiveness in this area is slightly lower compared to critical thinking and problem-solving. The higher standard deviation (0.73) indicates greater variability in responses, meaning that some students may feel less confident or proficient in their use of AI for developing their IT skills. This could reflect challenges in mastering more advanced technological functions or in areas that require more specialized training. Despite this, the overall positive perception implies that AI tools are still viewed as valuable in fostering IT competency, but it also points to the need for more targeted interventions or training to address gaps in technical proficiency. This observation is consistent with Biagini et al. (2023), who noted that while AI tools aid in digital engagement, mastering technical IT skills often requires additional focused training beyond general AI usage.

Table 8
Summary of Perceived Level of 21st Century Skills Development in Aid of AI Use

Statements	Mean	Standard Deviation	Description
Critical Thinking	3.56	0.49	At All Times
Information Technology Skills	3.37	0.73	At All Times
Problem-Solving Skills	3.62	0.49	At All Times
Overall	3.52	0.57	At All Times

Legend: 1.00-1.75 Never/Not Developed at All, 1.76-2.50 Sometimes/Slightly Developed, 2.51-3.25 Most of the Time/Moderately Developed, and 3.26-4.00 At All Times/Highly Developed

Table 9 presents the correlation between the respondents' perceived use of artificial intelligence in three dimensions: effectiveness, proficiency, and advanced students' skills, and their 21st-century skills, which include critical thinking, information technology, and problem-solving. The data,

presented through correlation coefficient (r-values) and p-values, reveals the significance of these relationships. A significant relationship is denoted when the p-value is less than 0.05, marked as "S" in the table, while a p-value greater than 0.05 indicates non-significance (NS). As observed, all variables are marked as "S", suggesting statistically significant relationships across the dimensions. This indicates that students who perceive AI tools as more effective, proficient, and advanced tend to show stronger development in critical thinking, problem-solving, and information technology skills. This supports the work of Adewale et al. (2024), who found that AI-based predictive systems significantly enhanced students' performance, particularly in identifying at-risk learners and promoting targeted interventions.

The strongest correlations were observed in critical thinking ($r = .575$, $p = .000$) and problem-solving skills ($r = .573$, $p = .000$), both showing strong, statistically significant relationships. This indicates that the students who perceive AI tools as effective tend to have better critical thinking and problem-solving skills. The positive correlation suggests that AI tools may contribute most directly to cognitive and analytical processes, enabling students to think critically, evaluate arguments, and solve complex problems. These results align with Salido (2023), who argued that AI personalizes learning and deepens comprehension, fostering qualities that strengthen critical thinking and problem-solving.

Meanwhile, the correlation between the use of artificial intelligence (AI) tools and information technology skills is weaker but still significant ($r = .297$, $p = .000$). This finding suggests that while AI tools help facilitate digital interaction, they do not necessarily result in mastery of technical information systems. The weaker correlation with information technology skills may reflect that AI's role in digital engagement is more about supporting students' interaction with technology rather than teaching in-depth technical skills. Despite this, the relationship remains significant, indicating that AI tools are still helpful in fostering technological engagement. This is consistent with Biagini et al. (2023), who noted that while AI tools enhance digital engagement, mastery of specific information technology skills may require more focused training.

The overall correlation between the use of artificial intelligence tools and students' 21st-century skills ($r = .501$, $p = .000$) shows a strong and significant relationship. This suggests that as students perceive AI tools as more effective, their 21st-century skills, including critical thinking, problem-solving, and information technology proficiency, tend to improve accordingly. The data confirms that AI tools not only support academic performance but also contribute to the development of essential cognitive and technical competencies needed for success in modern education and the workforce. These findings underscore that AI tools play a key role in fostering critical learning behaviors and intellectual growth, supporting the arguments made by Adewale et al. (2024), who concluded that AI tools enhance student engagement and improve both performance and learning habits.

Table 9
Results of the Test on Significant Relationship between the Respondents' Perceived Use of Artificial Intelligence Tools and the Students' 21st Century Skills

Variables	Critical Thinking Skills			Information Technology Skills			Problem-Solving Skills			Overall		
	r-value	p-value	Int	r-value	p-value	Int	r-value	p-value	Int	r-value	p-value	Int
Effectiveness	.575**	.000	S	.297**	.000	S	.573**	.000	S	.501**	.000	S
Proficiency	.506**	.000	S	.242**	.000	S	.503**	.000	S	.429**	.000	S
Advanced Students' Skills	.690**	.000	S	.352**	.000	S	.692**	.000	S	.600**	.000	S

CONCLUSION

This study examined the significant role of artificial intelligence (AI) tools in the development of 21st-century skills, including critical thinking, problem-solving, and information technology skills, among students at the South Cluster Campuses of Bukidnon State University. The findings reveal that students perceive AI tools as highly effective in enhancing their academic skills. The results indicate a strong positive correlation between the use of AI tools and improvements in their cognitive abilities, especially in critical thinking and problem-solving. AI's ability to provide personalized learning experiences and real-time feedback significantly contributes to students' overall academic performance and intellectual growth. As students engage more with AI, they develop greater proficiency in thinking critically, solving problems, and utilizing technology, which are essential for success in today's rapidly evolving digital landscape.

Furthermore, the study underscores the importance of incorporating AI into educational frameworks to promote the development of 21st-century skills. The data suggests that as students become more proficient in using AI tools, they exhibit enhanced analytical thinking, creativity, and digital literacy. However, it is crucial for institutions to strike a balance between AI integration and human interaction to avoid over-reliance on technology, which could potentially hinder the development of independent learning and critical thinking. This research calls for continued efforts in designing AI-enhanced educational environments that foster skill development while ensuring ethical usage and responsible AI engagement.

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