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Beyond AI Dependency: Exploring the Effects of Artificial Intelligence Use on Secondary School Students' Creativity

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ABSTRACT

Artificial Intelligence (AI) is transforming modern education and greatly influencing our society including students and the education system. Access to information, modern collaborative tools and personalized learning has enhanced due to AI. Along with benefits AI also has some limitations like overdependence on AI, social detachment and declined critical thinking among students. Whereas, an important critical thinking skills for students is creativity that aids not only in personal and intellectual growth but also helps in converting raw opinions into actions and encouraging innovation and analytical thinking. The current study explores the effects of AI on the creativity of secondary school students in Karachi. A quantitative cross-sectional survey research design was used and both descriptive and inferential statistics were calculated. Further, 250 secondary school students of both public and private schools in Karachi city were selected as a sample of the study. A close-ended questionnaire four dimensions: ideation, creative thinking skills, creative self-efficacy, and over-reliance on AI was utilized for data collection. Data was analyzed using descriptive statistics and multiple linear regression in SPSS. Results indicated frequency of AI usage as a significant positive predictor of students' creativity ($B = 0.207$, $\beta = .263$, $p = .009$), whereas AI dependency was not a significant predictor of creativity ($B = 0.031$, $\beta = .041$, $p = .684$). The findings indicated that AI positively impacts students' creativity when used frequently and intentionally, but not merely through dependency on AI tools. The study recommends that AI be used as a supportive learning tool that enhances, rather than replaces, students' own creative abilities, and offers implications for teachers, students, school administrators, and policymakers regarding the responsible use of AI in secondary education.

Keywords: Artificial Intelligence, Creativity, Secondary School Students, AI Dependency, AI Usage Frequency, Karachi.

Introduction

AI (Artificial Intelligence) has arisen globally as a great agent of change in modern education. It has greatly influenced our society including students and education system. It has enhanced access to information, upgraded collaborating tools, and empowered personalized learning. While preparing students for the digital literacy, it also offers limitations like declined critical thinking, overdependence on AI, reduced bodily exertion, and social detachment. AI tools such

as chat GPT, content generators, mechanized learning platforms support students to complete tasks effectively and generate ideas. The usage of these tools has altered the students' learning style. Creativity is an important cognitive skill for students' personal and intellectual growth. It converts raw opinions into actions, encourages innovation and analytical thinking. There is a constant debate among educationalists concerning the impact of AI on students' learning. Some thinks it negatively influences students' creativity, whereas other believes it reduces originalities. This study aims to explore the effects of AI on students' creativity at secondary level in Karachi and investigate whether AI positively or negatively impacts their creativity.

Among students, the use of Artificial Intelligence (AI) has rapidly increased (Zawacki-Richter et al., 2019). While it offers efficiency, concerns have also been raised about its influence on students' creativity and analytical skills (Kasneci et al., 2023). Some investigators believe that the constant use of AI tools for assignments and problem-solving hinders students' imagination and innovations (Dwivedi et al., 2023), while others claim that AI provides exposure to diverse viewpoints, offers inspirations, and advanced learning opportunities (Luckin et al., 2016). This modification in belief has developed a need for detailed investigation of the real effects of AI on students' creativity, and the connection between artificial intelligence and students' creativity has become a significant part of educational research.

In Karachi, the use of technology among students has increased pointedly; however, limited research has been carried out to examine how AI affects their creativity. There is limited awareness in relation to whether AI increases students' thoughts and modernization or produces dependency that actually declines their power of imagination and rigorous evaluation (UNESCO, 2023). Thus, this study intends to investigate the consequences of artificial intelligence on the creativity of secondary level students in Karachi, to benefit educators, parents, and representatives in recognizing the enlightening impact of AI and the need for its composed and effective usage in classrooms.

Research Objectives

1. To explore the usage of Artificial Intelligence tools among students in Karachi.
2. To explore the effect of artificial intelligence on the creativity of secondary level students in Karachi.

Research Questions

1. To what extent do secondary school students in Karachi use Artificial Intelligence tools for academic purposes?
2. What is the effect of Artificial Intelligence (AI) on the creativity of secondary school students in Karachi?

Hypothesis

H₀: There is no significant effect of artificial intelligence on the creativity of secondary level students in Karachi.

Literature Review

Artificial Intelligence in Education

Artificial Intelligence (AI) is a branch of computer science that focuses on creating software and machines that can *think* or act in ways similar to humans. Further, in education, AI can act like a smart assistant, giving students personalized lessons, instant feedback, and engaging content to help them learn better and faster (Tulasi & Rao, 2023). AI is also described as a tangible real-world capability of non-human machines or artificial entities to perform, task solve, communicate, interact, and act logically as it occurs with biological humans (Gil de Zúñiga, Goyanes & Durotoye, 2023). AI should not merely be viewed as a technological tool but as a

conceptual framework that helps explain the interaction between humans and intelligent systems.

The researchers further proposed two important dimensions for understanding AI Which are performance level and autonomy level. The extent to which AI system can accomplish various cognitive function including identification of patterns, analyzing large information and identifying solution to complex problems is referred as level of performanc. Whereas, the degree of independence with which an AI system operates, ranging from simple recommendation tools to advanced generative AI applications capable of producing content independently is described as autonomy level (Morris et al., 2024). Concerns related to student dependence, critical thinking, and creativity become more significant as autonomy in AI increases which makes this dimension particularly relevant for educational research.

Generative Artificial Intelligence in Education

Generative models in AI systems are trained for identifying patterns and utilizing deep learning techniques to combine and recombine existing elements in order to produce new creative text, images, music, or ideas (Elhanashi et al., 2026). Through idea generation, brainstorming and content development AI can serve a supportive role in educational processes. AI systems are not restricted to generate only one response to a single prompt but they have a capability to generate multiple options that allows the user to choose the most relevant one, and in educational context it helps the students to expand their thinking by overcoming creative blocks. AI-based tools like ChatGPT, Gemini etc generate response by learned patterns that provide multiple suggestions and structured outputs for students to stimulate their creative thinking (Rahman et al., 2025).

Creativity in Education

Utilization of imagination or original ideas to produce meaningful outcomes in terms of artistic, written, or problem-solving work is termed as creativity. Traditionally, creativity was considered as a unique human ability that is shaped by cognitive processes, relevant experiences and emotions (Sawyer & Henriksen, 2024). However, this assumption is now being challenged by the rapid development of (AI) as it introduces the systems that are capable of generating outputs that resemble human creativity. Creativity is a multidimensional construct that involves the ability to produce ideas or outcomes that are both innovative and appropriate for a specific context (Amabile, 2018; Runco & Jaeger, 2012). It involves the ability to connect seemingly unrelated concepts along with flexibility and domain knowledge (Glăveanu & Beghetto, 2021; Kaufman & Sternberg, 2019).

Artificial Intelligence and Students' Creativity

AI is considered as a co-creative tool rather than an independent creator, increasingly conceptualized as an augmentation system that supports human creativity by generating design alternatives and expanding idea exploration (Figoli et al., 2022; Liao et al., 2020; Tigre Moura et al., 2023; Wingström et al., 2022). Research indicates that AI-supported environments may enhance creative exploration by increasing access to ideas and perspectives (Anantrasirichai & Bull, 2022); however, the impact of AI depends on how it is used. AI can generate creative-like outputs but researcher has raised a concern that as AI does not possess consciousness, emotions, or lived experiences, which are essential components of human creativity, also AI lacks intentionality and understanding of meaning then can we consider these AI systems be truly creative (Haase & Hanel, 2023; Wang et al., 2024). Another perspective suggested to see AI as a catalyst for enhancing creativity but not as a replacement for human creativity. Further, human engagement is an important component that may affect the creative value of AI. Active engagement of students in terms of evaluation and modification

with AI outputs is necessary to enhance their creativity. Whereas, if students remain passive and just copy paste the content from the AI outputs without putting their human efforts it might limit their independent thinking and originality (Saritepeci & Yildiz Durak, 2024). It indicates that AI impact on creativity is not static but dependent on the usage in the educational context.

Benefits and Challenges of AI

AI is transforming education and providing numerous benefits to students such as; providing accessible information, covering diverse learning needs, providing personalized feedback for students, scalability, reducing teacher's workload, engaging students through interaction and providing preparing students for real-life experiences like job interviews etc (Hwang et al., 2020).

As everything has some pros and cons similarly AI is also having some concerns associated like more dependency on AI tools and putting less human input that may reduce independent thinking and creative development (Saritepeci & Yildiz Durak, 2024). Further, students may lose confidence on their creative abilities due to excessive reliance on AI (Jia & Tu, 2024; Habib et al., 2024). In addition to this, challenges related to ethics, academic integrity, data privacy, and human dependency on technology remained a central concern in AI adoption as well. Such concerns include; privacy of data, plagiarism, less human interaction and biased algorithmic (Chen et al., 2020; Hwang et al., 2020).

Artificial Intelligence Usage among Secondary School Students

Artificial Intelligence (AI) has become increasingly integrated into the learning practices of secondary school students, particularly through generative AI tools such as ChatGPT, Google Gemini, and Microsoft Copilot. Students commonly use these tools for information retrieval, homework assistance, brainstorming, language learning, content generation, and exam preparation. The widespread availability of AI-powered applications has transformed learning by providing immediate feedback, personalized support, and interactive educational experiences (Kasneci et al., 2023). Research suggests that students perceive AI tools as useful for improving learning efficiency, enhancing understanding of complex concepts, and supporting independent study (Baidoo-Anu & Ansah, 2023). However, the frequency and purpose of AI use vary among students, and concerns remain regarding excessive dependence on AI, which may reduce critical thinking and originality if these tools replace rather than support students' own cognitive efforts (UNESCO, 2023).

Theoretical Framework

The present study is grounded in the Componential Theory of Creativity proposed by Amabile (1983, 1996), which explains that creativity results from the interaction of three essential components: domain-relevant skills, creativity-relevant processes, and intrinsic motivation. Domain-relevant skills refer to the knowledge and expertise required to perform a task, creativity-relevant processes include cognitive abilities such as originality, flexibility, and problem-solving, while intrinsic motivation reflects an individual's interest and willingness to engage in creative activities (Amabile, 1996).

Within the educational context, Artificial Intelligence (AI) can support these components by providing students with immediate access to information, personalized feedback, brainstorming assistance, and multiple perspectives for solving problems. These features can enhance students' idea generation, creative thinking skills, and creative self-efficacy. However, the theory also suggests that creativity depends on learners' active cognitive engagement rather than external assistance alone. Therefore, excessive reliance on AI may reduce independent thinking and originality, potentially limiting creative development.

The Componential Theory of Creativity provides a suitable framework for explaining the relationship between AI usage and students' creativity. It suggests that when AI is used as a supportive learning tool rather than a substitute for students' own thinking, it can facilitate creative performance by enhancing knowledge acquisition, motivation, and creative problem-solving. This theoretical perspective aligns with the present study, which investigates whether the frequency of AI use and dependency on AI influence the creativity of secondary school students.

Research Gap

Artificial intelligence (AI) literacy education has emerged as an essential competency in secondary education aimed at equipping students with digital skills required for effective evaluation, communication, collaboration, and ethical use of AI technologies in academic, home, and workplace environments (Ng et al., 2023). Despite this development, there is still a lack of comprehensive reviews that systematically summarize AI education practices at the secondary school level (Ng et al., 2023).

Although Artificial Intelligence has gained significant attention in education, several important gaps still exist. Most existing studies have focused on the technical use of AI tools such as generative AI, intelligent tutoring systems, and learning analytics, while less attention has been given to how these tools actually influence students' thinking and learning behaviors, and ethical concerns regarding overreliance on AI tools remain underexplored. Although previous research confirms that AI can improve learning performance, there is limited empirical evidence explaining how continuous AI use may shape students' creativity, independence in thinking, and self-reliance in learning processes; in particular, the potential dependency of students on AI tools and its impact on reshaping creative thinking has not been sufficiently explored, and most studies are conducted in developed contexts, with limited evidence from developing educational settings such as Pakistan. Therefore, further research is needed to explore how Artificial Intelligence influences students' creativity at the secondary level, particularly the extent to which AI use enhances or creates dependency and affects independent creative thinking.

Research Methodology

This study employs a quantitative cross-sectional survey research design along with predictive correlational approach. Both descriptive and inferential statistics were used for data analysis. A cross-sectional survey design is appropriate for collecting data from a population at a single point in time and examining associations among variables efficiently (Creswell & Creswell, 2018). Furthermore, a predictive correlational approach using multiple linear regression is suitable for determining the extent to which independent variables predict the dependent variable without manipulating the study variables (Fraenkel et al., 2019). Data was collected using close-ended structured questionnaire based on 5-point Likert scale, a method that ensures consistency in data collection and is considered a reliable tool for measuring perceptions and outcomes in educational research (Check & Schutt, 2018). The tool was adapted from Kazmi, Ahmad and Siddique (2025) ChatGPT reliance scale. Further, to analyze the data, descriptive statistics (percentages) were used to summarize respondents' demographic characteristics and patterns of AI usage among students. In addition, inferential statistical techniques, specifically simple and multiple linear regression, were applied to examine the relationship between AI usage and students' creativity. The sample of the study was 250 secondary school students in Karachi that were selected by using stratified convenience sampling technique to ensure appropriate representation of both public and private school participants. Stratification divides the population into distinct subgroups based

on school type, allowing for a more accurate comparison between these two educational contexts (Etikan & Bala, 2017); within each stratum, schools are randomly selected to reduce selection bias, and students are then chosen based on convenience and accessibility.

A five-point Likert scale questionnaire was used with two section one for demographic information and other containing statements related to both variables. To ensure content validity, the research instrument was reviewed by five academic experts with specialized knowledge. Further, the internal consistency of the questionnaire was assessed using Cronbach's alpha, which yielded a value of 0.87, indicating a high level of reliability (Taber, 2018).

Data collection was started after taking consent from both principal of the school and research participants. With the help of school administration, the questionnaire was administered using Google Forms, and the survey link was shared digitally through WhatsApp, Facebook, and Messenger, targeting selected students from public and private secondary schools in Karachi.

4. Data Analysis and Interpretation

Data collected from 250 secondary school students in Karachi were analyzed using the Statistical Package for the Social Sciences (SPSS). Demographic characteristics were summarized using descriptive statistics including frequency and percentage, while for testing the hypothesis simple and multiple linear regression were used. The 15 statements were divided into 10 items focused on the perceived creative benefit of AI (idea generation, brainstorming, problem solving) and 5 items focused on perceived dependency or risk (over-reliance, reduced original thinking), measured on a five-point Likert scale coded 1 through 5. A Creativity Score and a Dependency Score were computed for each respondent as the average of the scores of the respective items, and all regression coefficients were determined using Ordinary Least Squares (OLS) regression, with a significance level of 5% ($p < .05$).

4.2 Demographic Characteristics of Respondents

Table 4.1

Distribution of Respondents by Gender (N = 250)

Demographic Variable	Type	Percentage
Gender	Female	76.0
	Male	24.0
	Total	100.0

Table 4.1 is representing the distribution of respondents based on the gender. Out of the 100 respondents, 76% were female and 24% were male, giving significant representation to girls' perspectives on the application of AI in learning while male respondents also contributed to a diverse set of views.

Table 4.2

Distribution of Respondents by Age (N = 250)

Demographic Variable	Type	Percentage
Age	13 years	4.0
	14 years	28.0
	15 years	30.0
	16+ years	38.0
	Total	100.0

This age profile of the respondents is shown in Table 4.2. The largest group of respondents were in the groups of 16 years and over (38.0%), 15 years (30.0%) and 14 years (28.0%). 4.0% of the respondents were 13 years. This distribution suggests that the study is largely

representative of students towards the end of secondary school who have a greater familiarity with digital technologies and tools for learning with a basis in artificial intelligence.

Table 4.3

Distribution of Respondents by Frequency of AI Tool Use (N = 250)

Demographic Variable	Type	Percentage
AI Tool Usage	Daily	41.0
	Weekly	30.0
	Rarely	28.0
	Never	1.0
	Total	100.0

The above table is representing a frequency of AI tool usage, 41.0% of respondents were daily users, 30.0% were weekly users, 28.0% used AI tools rarely, and 1.0% reported never using AI tools. This implies that the use of AI technologies has been ingrained in students' educational experiences, making this sample suitable for examining the connections between AI use and creativity.

Table 4.4

Distribution of Respondents by Average Percentage in the Last Annual Examination (N = 250)

Demographic Variable	Type	Percentage
Annual Percentage	60–69%	10.0
	70–79%	28.0
	80–89%	44.0
	90–99%	18.0
	Total	100.0

Table 4.4 shows the academic results of the respondents in such a way that they had obtained in the last Annual exam. The most common marking range was 80% - 89% with almost half of the students (44.0%) in this band. Those who scored in the 28th percentile achieved 70- to 79-percent, and 18th percentile achieved between 90-to 99-percent. The remaining 10.0% achieved 60%–69%. The overall academic profile of the sample is of a relatively high-achieving student group that could be able to give informed responses to questions on the educational use of AI.

Table 4.5

Model Summary for the Effect of AI Usage Frequency on Creativity (N = 250)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.263	.069	.059	0.384

The model summary from the simple linear regression in which AI usage frequency was the independent variable in an attempt to predict students' creativity is illustrated in Table 4.5. The correlation coefficient ($R = .263$) shows that there is a weak positive correlation between the frequency of use of AI and creativity. Overall, the coefficient of determination ($R^2 = .069$) indicates that 6.9% of the variance in creativity scores was accounted for by the frequency of AI use, while the other 93.1% of variance was due to factors other than the variables actually used in the current model. After sample size was accounted for the adjusted R^2 value was .059, suggesting that the model maintained a small amount of explanatory power.

Table 4.6*ANOVA for the Regression Model Predicting Creativity*

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.064	1	1.064	7.21	.009
Residual	14.462	98	0.148		
Total	15.526	99			

Table 4.6 illustrates the results of the analysis of variance (ANOVA) for the regression model. Analysis of the results showed that the regression model was significant $F(1, 98) = 7.21, p = .009$. Because the significance value is less than .05 alpha, regression model was able to predict students' creativity significantly. The results point that frequency of AI usage is a major aspect of determining the differences in creativity among those interviewed.

Table 4.7*Regression Coefficients for AI Usage Frequency Predicting Creativity*

Predictor	B	Std. Error	Beta	T	Sig.
Constant	3.251	0.175	—	18.569	< .001
AI Usage Frequency	0.207	0.077	.263	2.685	.009

Table 4.7 represents the regression coefficients for the frequency of use of AI. The intercept ($B = 3.251$) represents the estimated creativity score for those students who responded "never" when asked about their AI usage. The regression coefficient for AI usage frequency ($B = 0.207$) suggests that a one-unit rise in the use frequency of AI will lead to about a 0.21-unit increment in the predicted score on creativity. In addition, the standardized regression coefficient is positive ($\beta = .263$) which implies there is a positive correlation between the frequency of using AI and creativity. The predictor was found to be statistically significant ($t = 2.685, p = .009$); this indicated that students who make more use of AI are more likely to score higher for creativity.

Table 4.8*Model Summary for the Effect of AI Dependency on Creativity (N = 250)*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.041	.002	-.008	0.398

Note. Predictor: AI Dependency Score; Dependent Variable: Creativity Score.

Table 4.8 graphically shows the model summary of the simple linear regression analysis that was carried out to see the influence of student AI dependency on students' creativity. This correlation coefficient is very small and positive ($R = .041$) and could suggest a very weak correlation between AI dependency and creativity. The R^2 value for the coefficient of determination is .002, meaning that at most, 0.2% of the variance in creativity scores was explained by AI dependency. Thus, the variability in creativity is 99.8% due to other factors rather than to variability in dependency on AI. The negative adjusted R^2 score ($-.008$) also shows that there is practically no predictive power of the model in adjusted for sample size, implying that dependence in AI doesn't explain students' creativity to a significant level.

Table 4.9*ANOVA for the Regression Model Predicting Creativity*

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.027	1	0.027	0.17	.684
Residual	15.499	98	0.158		

Total	15.526	99			
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The results of the ANOVA testing of the regression model are given below in Table 4.9. As it turned out, the regression was not a significant model, $F(1,98) = 0.17$, $p = .684$. The significance value acquired is much higher than the alpha level which is .05 thus the model is not significantly able to predict students' creativity. Hence, it cannot be attributed that there was a significant difference in creativity between the respondents due to the dependency of AI.

Table 4.10

Regression Coefficients for AI Dependency Predicting Creativity

Predictor	B	Std. Error	Beta	t	Sig.
Constant	3.588	0.253	—	14.203	< .001
AI Dependency Score	0.031	0.075	.041	0.408	.684

Note. Dependent Variable: Creativity Score.

The regression coefficients for dependency on AI is shown in Table 4.10. The intercept ($B = 3.588$) is the estimated creativity score at the point of an AI dependency score of 0. The regression coefficient (B) for AI dependency is 0.031, which means that for every unit increase in AI dependency, the prediction of the creativity score increases by 0.031 point. But again, it was not statistically significant ($\beta = .041$, $t = 0.408$, $p = .684$). Such evidence suggests that there is no strong relationship between the level of dependency on AI for the students' creativity. Put another way, based on our sample of students, dependence on the AI tools seems to be unrelated to creativity.

A multiple linear regression analysis was used to analyze the simultaneous effect of the frequency of using artificial intelligence and dependence on artificial intelligence on secondary school students' creativity. AI usage frequency (AUC) and AI dependency score (ADC) were modeled together as predictor variables, while creativity score (ARM) was modeled as the dependent variable.

Table 4.11

Model Summary for the Combined Effect of AI Usage Frequency and AI Dependency on Creativity (N = 250)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.263	.069	.049	0.386

Note. Predictors: AI Usage Frequency, AI Dependency Score; Dependent Variable: Creativity Score.

The value of the multiple correlation coefficient ($R = .263$) suggests the combined predictor variables had a low-level correlation with students' creativity. The coefficient of determination ($R^2 = .069$) indicates that 6.9% of the variance in creativity can be accounted for by the combination of frequency of using AI and dependency on AI. The adjusted R^2 of .049 suggests that despite the number of predictors entered into the model, there was still some power in the model. The model fitted is combined model and we can see that the ratio of variance explained is small but the results show that the combined model also help us in explaining the differences of the students' creativity.

Table 4.12

ANOVA for the Multiple Regression Model Predicting Creativity

Model	Sum of Squares	df	Mean Square	F
Regression	1.109	2	0.554	3.57
Residual	14.417	97	0.149	
Total	15.526	99		

The results of an ANOVA of the multiple regression model are displayed in Table 4.12. The results show that the overall equation of the regression model is statistically significant, $F(2, 97) = 3.57$, at $p = .032$. The significance value is less than .05, this means that the factors of the usage frequency of AI tools and the students' dependency on AI has a significant relationship in influencing the creativity of students. This indicates that both variables are to be taken into account together to get a statistically significant explanation of variations in creativity.

Table 4.13

Regression Coefficients for AI Usage Frequency and AI Dependency Predicting Creativity

Predictor	B	Std. Error	Beta	t	Sig.
Constant	3.251	0.277	—	11.759	< .001
AI Usage Frequency	0.207	0.078	.259	2.638	.010
AI Dependency Score	-0.000	0.074	-.000	-0.001	.999

Note. Dependent Variable: Creativity Score.

The regression coefficient for each of the two predictor variables in the model are displayed in Table 4.13. The frequency of using AI positively predicted creativity, the value was statistically significant ($B = 0.207$, $\beta = .259$, $t = 2.638$, $p = .010$). This suggests a general trend whereby greater AI use was associated with higher creativity scores even after accounting for their AI dependency.

Conversely, AI dependency was not a significant predictor of creativity ($B = -0.000$, $\beta = -.000$, $t = -0.001$, $p = .999$). The coefficient ended up being virtually null, implying that there was no significant association between the level of dependence on AI and creativity, when factoring in AI use frequency. The results thus indicate that what matters more is the frequency of leverage for AI and not the students' dependence on AI tools for the positive influence on creativity.

Findings and Discussion

Most respondents reported that AI helps them come up with new ideas, brainstorm ideas faster, and introduces them to new perspectives, suggesting that AI is a tool that can be used in the ideation phase of the creative process in education. These results agree with the findings of Baidoo-Anu and Ansah (2023), who found that generative Artificial Intelligence enhances students' learning by allowing them to develop their ideas, explore freely, and boost academic engagement. Similarly, Kasneci et al., (2023) concluded that AI education technology offers timely advancements and customized support that aids in sparking students' creativity and problem-solving abilities, consistent with Hwang et al., (2020) and Chen et al., (2020), who found that AI enables interactive learning environments where students actively learn rather than passively receive information. However, these findings should not be seen as AI taking the place of students' creativity; rather, students still need critical thinking skills to process data, evaluate AI-proposed ideas, and integrate them to generate new ideas.

Most respondents indicated that AI assists in finding other ways to solve problems, leads them to think outside the obvious solutions, allows them to tie up ideas in new ways, and helps them solve problems more creatively, indicating that AI has a positive impact on students' divergent thinking. Supporting these findings, Chen et al., (2020) indicated that Artificial Intelligence can foster higher-order thinking skills by allowing students to have adaptive learning and prompting them to analyze, evaluate, and solve problems by themselves, while Kasneci et al., (2023) concluded that Generative Artificial Intelligence can help shape learning through inquiry, exploration, and creative problem-solving. While the results show how AI can enhance creative

thinking, the educational value of AI is linked to how the technology is applied; students who critically engage with AI-generated answers, adjust AI ideas, and combine them with their own knowledge are more likely to develop creative thinking than those who simply copy AI-generated answers.

Most participants reported that AI assists them to express their ideas better, become more confident when doing creative tasks, and encourages them to seek new ideas, indicating that AI can make a significant impact both in idea generation and in how clearly, organized, and creatively students can communicate their concepts. This result is similar to that of Baidoo-Anu and Ansah (2023) found that using Generative Artificial Intelligence to assist students in organizing their ideas and improving written communication raises students' academic productivity, and to Pritchard (2023) posited that AI empowers learners in the creative writing process by helping them navigate writer's block and enrich their ideas. Despite these positive results, AI should be considered an additional tool for teaching and learning rather than a substitute for students' creativity, since students' imagination, vivid experiences, critical judgement, and originality remain necessary for authentic creative expression.

The results indicate that the frequency of AI usage significantly and positively impacted students' creativity, with students reporting high utilization of AI tools showing higher creativity than those with low utilization. This finding aligns with the studies of Baidoo-Anu and Ansah (2023) and Kasneci et al., (2023) which stated that AI-supported learning environments foster students' creative skills through personalized assistance, instant feedback, and opportunities for exploration, and with Chen et al., (2020) who found that AI-assisted education systems help students engage with learning content in more meaningful and engaging ways, developing higher-order thinking skills such as creativity. This finding has an important implication for education: schools should encourage the development of students' mindsets for using AI rather than limiting access to AI technologies, since AI, when properly integrated into classroom learning, can empower secondary school students to become more creative, innovative, and effective problem-solvers.

The statistical analysis showed that AI dependency did not significantly correlate with students' creativity level, indicating that the mere use of AI does not intrinsically improve or reduce creativity, and that creativity appears to be more about how students utilize AI than about their reliance on it. This finding contrasts with some studies, such as Terry (2023) and Fest (2023), that warn of the dangers of relying too heavily on AI-generated content, which can deter original thinking and lessen opportunities for autonomous learning. This finding could be attributed to the fact that a large number of students apply AI as an auxiliary learning medium rather than a full substitute for their own thinking; descriptive results showed that students appreciated AI as a supporting tool for idea generation and problem solving while also understanding the need for effort and originality in their own work. Other factors such as motivation, prior knowledge, learning environment, teacher support, and personal interests may also influence creativity alongside dependence on AI.

Conclusion

The study aimed to explore the effect of AI on the creativity of secondary school students in Karachi. The descriptive correlation survey design along with descriptive and inferential statistics was used for analyzing the results. One of the most valuable aspects of this study is that it shifts the discourse about Artificial Intelligence from a prejudicial framing toward either purely positive or purely negative outcomes. The results indicated that AI usefulness for education is dependent on how students are utilizing it. Students' creativity can be enhanced through AI but if they utilize this tool through meaningful and regular interactions. Usage of AI

alone without human input and critical thinking might not have a notable impact on students' creativity. Further, descriptive results of the study indicated that participants mostly utilized AI for generating ideas, brainstorming, exchanging viewpoints, expressing ideas in a better way and problem solving. Whereas, the regression analysis showed that the frequency of AI use was statistically significant and positively related to students' creativity. Further, no statistically significant relationship was found between creativity and AI dependency. This highlights that using AI alone does not necessarily increase or decrease students' creativity instead, creativity is dependent on students' own critical thinking, imagination, ability to assess AI-generated ideas, making necessary adaptations and keeping originality in task. In conclusion, the study reveals that AI can be a positive influence on the creativity of secondary school learners when used responsibly in teaching and learning, and it underscores the need for promoting responsible and balanced AI utilization to benefit students' creativity while maintaining originality, critical thinking, and honesty.

Recommendations

- AI tools can be promoted in the classroom for brainstorming activities, creative writing, problem solving and project-based learning.
- Teachers are required to ensure that AI-generated responses are not directly copied from the AI outputs and students on creativity and originality must be present in their work.
- Students should apply Artificial Intelligence tools to broaden their thinking and spark ideas, without using AI to complete assignment work independently, and should critically assess AI-generated information before using it to guarantee the authenticity and originality of their assignments.
- School administrators should prioritize investing in the effective and ethical utilization of Artificial Intelligence in the educational process.
- Proper training related to the use of AI and AI related policies must be provided to both teachers and students.
- Curriculum developers and policymakers should include Artificial Intelligence literacy as a lifelong skill in the secondary school curriculum and develop national guidelines that foster the ethical and responsible use of Artificial Intelligence in educational settings.

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