

## How do AI chatbots impact high school students ' creativity? A case study at SMA IT Insan Kamil Karanganyar

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### ABSTRACT

Rapid technological advancement has resulted in various improvements that simplify human activities. Nevertheless, this heightened efficiency brings up a crucial issue: how can student creativity be fostered, particularly when delving into varied and innovative ideas? This case study was conducted at IT Insan Kamil High School to explore the use of generative chatbots as cognitive tools that can enhance student creativity. Three main components will be used to assess creativity improvement: fluency, flexibility, and originality of ideas. The data collection utilized a qualitative case study approach, featuring structured participatory observation, detailed interviews with students and teachers, and an in-depth analysis of student work materials produced during the chatbot intervention. Initial findings indicate that chatbots aid students in overcoming problems. Preliminary findings indicate that chatbots help students overcome anxiety (idea block). Chatbots can provide quick and consistent feedback. As a result, the expected outcomes will show a notable rise in student creativity scores, especially in terms of fluency and originality. This will demonstrate that chatbots can be well integrated into the school curriculum. By providing a structured model for the adoption of Artificial Intelligence (AI) to support important 21st-century skills, this research makes an important empirical contribution to pedagogical approaches in middle schools.

Keywords: AI Chatbots; Student Creativity; Fluency; Originality; Pedagogical Shift; Case Study; High School Education.

### Introduction

Technological developments, particularly in the field of AI or chatbots, have been welcomed by the community. It was found that 82% of the Kalaparea Village community utilizes AI applications for digital information, with search engines being the most prevalent indicator of usage (Juantara et al., 2024). AI has been

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utilized in various sectors, including education to improve students' mental acuity, health, economics, and even agriculture through smart gardens (Wahyudi, 2023). Moreover, in this era of Society 5.0, the use of AI is so ingrained in humans, especially in improving productivity efficiency for a better quality of life (Sawitri, 2025), especially since AI can perform repetitive, complex tasks and analyze large amounts of data more efficiently than humans (Ramadhina et al., 2023).

The integration of AI technology in the era of Society 5.0 ultimately demands fundamental changes in the education sector. In addition to the increasing integration of AI in education, teachers need to evolve significantly, emphasizing mentoring and ethically supervising these sophisticated digital machines rather than competing with them (Əşrəfova, 2025). However, it requires prudent regulation, data security, and the availability of digital infrastructure, as well as literature that explicitly promotes social justice and innovation (Sawitri, 2025).

Educators hope that the presence of AI chatbots in the education sector will complement or become a facility that helps students' education, because AI itself provides personalized learning facilities that adapt to the unique needs of each student in order to achieve the desired results (Ayuningtyas & Oktafiandi, 2024; Bettayeb et al., 2024). AI chatbots have been proven to significantly increase student motivation, as demonstrated by experimental tests comparing chatbot user groups with control groups (Juanta et al., 2024). This technology provides quick responses, interactive explanations, and support for understanding concepts that can be accessed anytime, anywhere (Suprihartini et al., 2025).

The public has high expectations for the use of AI chatbots. However, many studies show a significant gap between user expectations and the actual performance of chatbots in various fields (Suta et al., 2020), for example, in a health application, analysis of 708 user reviews confirmed an apparent mismatch between user needs and the user experience provided by a popular health chatbot application (Barbara Onyekwelu et al., 2024). Similar to the education sector, chatbots reveal a gap between user expectations and actual experiences in the real world (Van Der Zandt et al., 2021).

AI has been proven to accelerate the brainstorming process in the entrepreneurial sector, provide insights based on complex data, and aid in creating creative solutions to business challenges (Mulawarman et al., 2025). In higher education, the use of AI has shown a significant positive impact on optimizing the information reception process and improving the quality of academic services (Andika Isma et al., 2023). In the education sector, the use of AI chatbots in Indonesian language learning can stimulate students' creativity and improve literacy by providing timely feedback and personalized learning (Kurniawan et al., 2024).

The complementary use of AI chatbots is important because, although AI improves efficiency through rapid information processing, conventional education relies on students' ability to hone their creativity in independent analysis or problem-solving actively. Concerns arise from the risk that over-reliance on the efficiency of artificial intelligence (AI) could threaten traditional learning methods and potentially erode the critical cognitive efforts essential for deep understanding and creativity. In this study, the contribution will be to ensure

that AI chatbots support the enhancement of student creativity without dependence on them.

## Method

This study employs a qualitative methodology and an exploratory case study design. At IT Insan Kamil High School in Karanganyar, Central Java, this approach was used to thoroughly investigate how AI chatbots may foster student engagement, thereby facilitating the formulation of a generalized theory (Ary et al., 2010). By focusing on that specific context, this study can provide detailed insights into how AI chatbots can make an impact, the challenges faced in their use, and their effect on students' skills.

The participants involved in this study were 30 students and 10 teachers from IT Insan Kamil Karanganyar High School, and were supported by student work documents, because case studies do not only revolve around one individual but can involve a group of individuals, a community, or an institution (Ary et al., 2010). Overall, there are two classes, and the purpose of this study is to involve people who have experienced or seen AI chatbots in helping their creativity. The sample size is large enough for a qualitative research design because it allows for a deep and broad understanding of the participants' knowledge and experiences. Policymakers will have a broader understanding of how to implement AI chatbots to encourage increased creativity in students.

The research data used is derived from questionnaires distributed to students, serving as the primary data sources obtained directly in the field (Sugiyono, 2008). This research was based on interviews with teachers and observations of student work. It emphasized reflective and holistic analysis, which produced unique findings regarding the characteristics of AI chatbot usage that had not been previously identified (Assyakurrohim et al., 2022).

Data analysis in qualitative case study research is a systematic process that takes place during and after data collection. This process involves continuous interpretation to sharpen the focus of observation and deepen understanding of the research problem (Firman, 2018). In the context of case studies, researchers need to understand how to take the right approach, determine the scope of the research, and analyze the data carefully (Nurahma & Hendriani, 2021). Data analysis is inductive and dynamically evolving, requiring researchers to have specific skills in exploring the hidden meanings within the data (Qomaruddin & Sa'diyah, 2024). Data analysis begins with data collection and ensuring that all necessary data are complete and accurate (Assyakurrohim et al., 2022). The data are then read and reviewed to gain an initial understanding of their content (Ilhami et al., 2024). Next, the data were grouped according to Torrance's creativity assessment aspects of fluency, flexibility, and originality (Torrance, 2012). The data will then be developed into several broader concepts (Assyakurrohim et al., 2022). Finally, the data will be interpreted into a narrative text to build a new and in-depth argument for the AI chatbot.

## Results

### *How to improve student creativity?*

Creativity is an important factor in the birth of innovation, which in turn impacts competitive advantage. This topic is multidisciplinary, involving various fields such as management, engineering, social sciences, and the environment (Purwanitasari et al., 2025). In the context of education, teacher creativity primarily helps complete work quickly and efficiently, facilitates the transfer of information more completely, and stimulates students to think scientifically. Students' skills need to be developed into 21st-century skills (Supriatna, 2019).

There have been many studies on ways to improve creativity in high school students, one of which is through innovative learning approaches. Research on physics learning (Liliawati, 2011) shows that problem-based learning has been proven effective in improving the creative thinking skills of high school students, showing greater improvement compared to traditional learning in terms of fluency, flexibility, originality, and elaboration. In the study (Supriatna, 2019) on history lessons, 21<sup>st</sup>-century imaginative creativity can be developed through the 2013 Curriculum by placing students as actors in the history of their time. Research on the creativity of high school/vocational school students can be explored through an introduction to the industrial product design process, as the younger generation is believed to have a broader way of thinking and a sensitivity to envision a better world (Alfa et al., 2024).

Creativity assessment instruments include a rubric for scoring student creativity and a creativity ability test, which is a questionnaire distributed to students and teachers (Khusna et al., 2022). The questionnaire data will be averaged for each dimension of creativity assessment using the following formula:

$$\text{Average dimension scores: } \frac{\text{Total dimension score}}{\text{number of items in the dimension}} \quad (\text{Azwar, 1999})$$

The assessment score categories:

- a. 5.00 – 4.21= The chatbot AI has a substantial impact in this dimension.
- b. 4.20 – 3.41= The chatbot AI supports the impact of this dimension.
- c. 3.40 – 2.61= The impact of chatbot AI is balanced in this dimension.
- d. 2.60 – 1.81 = AI chatbots are hampered in this regard.
- e. 1.80 – 1.00 = AI chatbots have no impact on this dimension.

The dimensions of creativity assessment used in this study include fluency, flexibility, originality, and motivation. Many studies have identified the role of motivation in enhancing creativity in various fields, such as the world of entrepreneurship, where motivation provides excellent support for creativity (Wibowo et al., 2020), and in the world of education at the high school level, which is considered to have a significant correlation between the two (Hia, 2023).

### *What is the difference between chatbots and AI?*

Artificial intelligence devices that can have text or voice interactions are known as AI-based chatbots (Haristiani, 2019). The primary distinction between

chatbots and artificial intelligence (AI) is that chatbots are a specific use of AI, primarily employing Natural Language Processing (NLP). In contrast, AI is a more general technology (Nugraha et al., 2025). Artificial intelligence (AI) chatbots have much promise in a variety of domains, including language acquisition, where users are more comfortable utilizing them than speaking with live teachers (Haristian, 2019).

### ***What role can AI chatbots play for students?***

AI chatbots are evolving to meet human needs. Early chatbots, such as ALICE, and virtual assistants like Apple's Siri, use AIML-driven systems (for example, Pandorabots) to help in various areas (Bahartyan et al., 2015). More advanced AI chatbots function as intellectual companions or partners for reasoning. They are helpful for clarifying complex concepts and helping users overcome difficulties in academic material (Yunda & Aliyah, 2025). AI chatbots are evolving to meet human needs. In the world of education, for example, smajo.ai is a chatbot used for interactive learning, equipped with visuals such as images or videos (Ayuningtyas & Oktafiandi, 2024). Instant messaging applications such as Line Messenger and Telegram Messenger are also integrated through chatbots to facilitate communication between students and lecturers (Gentia et al., 2020).

AI chatbots are becoming a popular and engaging interactive learning tool for high school students. They help students grasp complex material better, offer immediate feedback, and even boost their overall motivation to learn (Hutabri et al., 2025). When it comes to learning speaking skills, these interactive chatbots have shown a marked advantage over traditional teaching methods. Students who use them see significant improvement in their fluency, pronunciation, and confidence (Gurusinga et al., 2025). Most students view AI positively, recognizing its potential to personalize their learning experience, streamline administrative tasks related to their schooling, and prepare them for the demands of the digital workplace (Siregar et al., 2024). They are inclined to use these tools because they feel genuinely supported in their studies. Essentially, AI is seen as a way to increase student engagement and foster key abilities like critical thinking and problem-solving (Sukma et al., 2025).

While chatbots offer benefits like greater learning efficiency and personalized academic help, they still have some drawbacks, such as difficulty with contextual understanding and the risk of reducing human interaction (Hadid et al., 2024). Educational institutions need to improve students' literacy in technology, especially in the concept of AI, to support these 21st-century skills (Elyakim P et al., 2025). AI chatbots are becoming a tool for personalizing learning and supporting the development of 21st-century skills through collaborative platforms and STEM-based tools (Usman et al., 2025). Developing students' 21st-century skills should center on the "Four Cs": Critical Thinking, Collaboration, Communication, and Creativity (Mahrunnisya, 2023; Mardhiyah et al., 2021; Nahdi, 2019), as well as adaptability and technological skills (Mantau & Talango, 2023).

### ***How does the AI chatbot relate to creativity?***

A recent study (Mulawarman et al., 2025) among young entrepreneurs found that AI plays a significant role in enhancing creativity. AI can accelerate the brainstorming process, provide insights based on complex data, and help create creative solutions to business challenges. In the field of education, there has been an increase in creativity among high school students who use AI in learning to solve integral problems in mathematics (Suchahyo et al., 2023) and also in Indonesian language lessons (Kurniawan et al., 2024).

Table 1. Student Questionnaire Results

No	The Creative Aspect	Skor	Average	Categories
1	Fluency	509	3.35	Balanced
2	Flexibility	375	3.29	Balanced
3	Originality	593	3.12	Balanced
4	Motivation	343	3.01	Balanced

### ***The Impact of AI Chatbots on Fluency: Accelerating Early Ideation***

Qualitative findings indicate that AI chatbots are in the idea initiation or fluency phase, which has the highest impact compared to other phases (see Table 1. This is mainly related to the chatbot's ability to overcome initial creativity barriers (idea blocks) and speed up the task completion process.

In terms of student perception in the Fluency category, the average score obtained was 3.35, placing it at the highest position among all dimensions and within the Balanced category (Range 2.61 – 3.40).

The data on teachers' perceptions of the four aspects, as stated in this questionnaire, is supported by observations that show the highest scores on items reflecting the acceleration function of AI.

Table 2. Results of the teacher questionnaire interview on the Fluency aspect

Question	Description	Average	Categories
1	The use of AI Chatbots makes it easier for students to find new ideas for assignments.	4.21	Very Strong
3	AI Chatbots help students overcome initial obstacles (such as writer's block) when starting creative assignments.	4.21	Very Strong
4	Students' assignments are completed faster thanks to the help of AI Chatbots.	4.40	Very Strong
6	Students seem less enthusiastic about searching for information manually (from books/journals) after using AI Chatbots	2.00	Inhibits
7	The use of AI Chatbots reduces the time needed for students to develop their own ideas	1.80	No Impact
10	AI Chatbots help students understand complex concepts, which they then use in creative assignments	2.80	Balanced
20	The assignments submitted show an increase in depth of analysis, thanks to easy access to AI Chatbots	3.00	Balanced

This data consistently shows that teachers view AI chatbots as a Very Powerful tool (Range 4.21 – 5.00) for improving fluency. In interviews, teachers explained that chatbots function as draft generators, providing students with an instant starting point and thereby reducing time wasted due to confusion or lack of confidence when beginning tasks. However, there are also contrasting findings, where teachers observed that this efficiency comes at a price. In teacher interview item 6, it only scored 2.0, which means it hinders.

### ***The Impact of AI Chatbots on Flexibility: Exploring Various Perspectives***

The results of the interviews regarding teachers' perceptions of flexibility show strong support for specific items, especially those related to exploring diverse ideas and new approaches.

Table 3. Results of the questionnaire interviews with teachers regarding flexibility

Question	Description	Average	Categories
5	Students use AI Chatbots as brainstorming tools to generate diverse solutions.	3.60	Supportive
9	Students who use AI Chatbots generate more original ideas than those who do not use them.	2.20	Inhibitory
12	Students appear more willing to try different approaches to tasks after consulting with AI Chatbots.	3.00	Balanced
14	I see a transfer of skills (new abilities) acquired by students after interacting with AI Chatbots.	3.20	Balanced
16	Students' creativity is more stimulated when they have to modify and develop the output of the AI Chatbot.	3.40	Balanced
18	AI Chatbots can be tools that encourage design thinking	4.00	Supportive
28	The use of AI Chatbots forces me to place more emphasis on the process and justification of ideas, not just the result	4.00	Supportive

A score of 4.0 on the design thinking item and 3.6 on the brainstorming item shows that teachers observed the role of AI as Supportive (Range 3.41–4.20) in expanding students' horizons of ideas. Chatbots provide quick responses to various scenarios, allowing students to quickly modify or test different perspectives, which is the essence of Flexibility.

### ***The impact of AI chatbots on originality: The focus of creativity***

In Table 1, high school students' originality scored the lowest points among various other aspects, even though the average Originality score in this category was balanced. From teachers' observations of originality, which provided a more critical narrative, the data shows that AI chatbots tend to be Inhibiting (Range 1.81–2.60).

Table 4. Results of the teacher questionnaire interview on the aspect of Originality

Question	Description	Average	Categories
2	Students tend to submit assignments that are similar in format and structure to the results produced by AI chatbots.	2.00	Inhibiting

Question	Description	Average	Categories
8	I have to make assignments more complex so that AI chatbots cannot easily answer them.	2.40	Inhibiting
11	I have observed a decline in the uniqueness (originality) of most student assignments.	2.20	Inhibiting
13	AI chatbots make students more passive and dependent on machine-generated solutions.	2.20	Inhibiting
15	Assignments completed with the help of AI chatbots often lack a "personal touch" from the student.	2.60	Balanced
17	Students often ask AI chatbots to evaluate or improve their creative ideas.	3.20	Balanced
26	I find it difficult to distinguish between the student's original ideas and those generated by AI chatbots.	2.40	Inhibiting
29	I tend to give lower grades to assignments that I suspect were assisted by AI chatbots.	3.20	Balanced

Teachers' average scores on these items are consistently below the Balanced threshold, indicating observable concerns in the field. Qualitative narratives from teachers highlight that AI Chatbots create what could be termed "product uniformity" in the classroom. The tasks generated, while efficient, lack a personal touch and exhibit similar patterns across students, making it difficult for teachers to identify students' original ideas.

### ***Pedagogical Shift: Emphasizing Process***

This shift in impact (support for Fluency and inhibition of Originality) has clear pedagogical consequences. Teachers reported that AI chatbots forced them to change their assessment focus.

Table 5. Results of teacher interviews on Motivation or Pedagogical Shift

Question	Description	Average	Categories
19	Some students have lost the ability to process raw data and information independently.	1.60	No impact
21	Our school curriculum is adequate in teaching the ethical and creative use of AI chatbots.	1.80	Hindered
22	I need further training on how to use AI chatbots to encourage student creativity.	1.60	No impact
23	Our students view AI chatbots as a substitute for teachers in some aspects of learning.	3.00	Balanced
24	The implementation of rewards for original ideas developed outside of AI Chatbots is becoming more important today	4.00	Supported
25	The school environment has created an atmosphere that encourages students not to copy the answers from AI Chatbots simply	3.60	Supported

Question	Description	Average	Categories
27	There is a positive correlation between students who frequently use AI Chatbots and their creativity scores in my subjects	3.20	Balanced
30	Overall, AI Chatbots do more harm than good to student creativity in this school	3.80	Mendukung

Item 24 had the highest score of 4.00 in the Supportive category, indicating that teachers collectively responded to the challenge of Originality with strategies to strengthen processes and justify ideas. This observation led to a discovery: AI chatbots not only influence student creativity but also directly encourage transformation in curriculum design and assessment methods applied by teachers.

## Discussion

This Discussion section aims to explore the meaning of the research results “The Impact of AI Chatbots on High School Students' Creativity” by analyzing qualitative results (based on perceptions, interviews, and observations) in the context of existing theories and cases, as well as emphasizing possible limitations. This interpretation focuses on the contrasting dynamics between the acceleration of ideation (Fluency/Flexibility) and the pressure for uniqueness (Originality).

This study aims to explore the role of Generative AI Chatbots as cognitive tools in enhancing student creativity in the dimensions of Fluency, Flexibility, and Originality. The main finding, supported by the students' average score (total 3.19) and the teachers' qualitative analysis, is that AI Chatbots have a balanced impact overall.

The scientific interpretation shows that this impact is dichotomous. The increase in Fluency (the highest score of 3.35; supported by teacher item 4.4) is due to the chatbot's role as an instant cognitive partner (thinking partner). The chatbot effectively helps students overcome creative anxiety (idea block) and speeds up the drafting process. This reduces the cognitive effort required to start a task, a function that has been proven to increase motivation and reduce anxiety in an academic context (Gurusinga et al., 2025; Juanta et al., 2024).

However, pressure on Originality (lowest student score 3.12; teacher score 2.0 to 2.4) arises because AI chatbots tend to generate output based on existing data patterns. When students only copy or slightly modify the ideas generated by AI (Item 2: 2.0), it leads to the homogenization of products in the classroom, causing students' work to become similar to one another, even though it appears highly fluent individually.

### ***The Paradox of Collective Originality***

Teachers' concerns about difficulty distinguishing between students' original ideas and AI (Item 26: 2.4) are consistent with global findings on the risks of generative AI, notably the paradox of collective originality (Doshi & Hauser, 2024). Research shows that although AI is capable of generating ideas with Originality scores that rival humans in standard creativity tests, reliance on LLM output risks reducing collective novelty, meaning that students' ideas become less

diverse. This case study research in Karanganyar provides local empirical evidence that this dichotomy is fundamental at the high school level in Indonesia.

### ***Shift in AI Research Focus***

This case study differs from many previous local AI studies (e.g., the use of Photomath) that focused on convergent cognition (structured problem solving) and the improvement of metacognitive skills (Suchyo et al., 2023). Research at SMA IT Insan Kamil, focusing on Generative AI Chatbots, shifts the focus to divergent cognition (Fluency and Originality), in contrast. However, GenAI has proven to be superior in accelerating ideation; it poses ethical risks (AI-like idea copying) and the potential for a decline in critical cognitive effort (Item 6: 2.0, less enthusiasm for searching for manual information) (Julius et al., 2024).

### ***Pedagogical Implications and Limitations of the Study***

The finding that teachers actively emphasize the process and justification of ideas (Item 28: 4.0) indicates positive pedagogical adaptation. AI chatbots, in this context, can no longer be viewed as passive tools but rather as catalysts for curriculum transformation. These results support structured pedagogical models such as the “Pedagogy of Wonder” (Lindstrøm, 2021), which encourages students to use AI strategically to ask more profound questions and formulate more original solutions, rather than passively copying outputs.

This discussion concludes that AI chatbots effectively support the fluidity and flexibility of ideas in high school students, serving as a tool to remove initial creative barriers. However, these benefits are significantly offset by challenges in idea originality and potential cognitive dependence. Therefore, the main contribution of this research is to provide empirical case study data that supports the need for prudent AI adoption by integrating AI chatbots as creative partners for fluency. It also involves transforming the curriculum to demand originality by strongly emphasizing the process, justification, and ethics of ideas in secondary education.

### **Conclusion**

This exploratory case study aims to analyze the impact of Generative AI Chatbots on high school students' creativity in terms of Fluency, Flexibility, and Originality of ideas. Based on data triangulation from student and teacher questionnaires, in-depth interviews, and observation of work documents at IT Insan Kamil Karanganyar High School, the main findings consistently show a significant dichotomy of impact, which is the most important proposition of this study.

Overall, the impact of AI Chatbots on student creativity falls into the Balanced category (average score of 3.19), with details showing that idea acceleration has a positive impact, as AI Chatbots have proven to be very effective as thinking partners in the early stages of the creative process, supporting Fluency (teacher score 4.2-4.4) and Flexibility (teacher score 3.6-4.0) of ideas and helps overcome initial obstacles (idea blocks) and speeds up task completion. The scientific justification is that LLM (Large Language Model) technology

reduces creative anxiety and provides quick feedback, which instantly increases the volume and variety of ideas.

The most critical impact is seen in the Originality dimension. Teachers consistently rated this aspect as Inhibited (score 2.0-2.4), because students tended to submit assignments whose format and structure resembled AI chatbot outputs. These findings confirm the paradox of collective originality: although AI can enhance individual creativity, reliance on algorithmic output patterns risks homogenizing ideas and reducing the uniqueness of work in the classroom.

This case study bridges the gap between local AI research, which tends to focus on specific AI (convergent cognition), and global GenAI literature (divergent cognition). This research empirically provides evidence from Indonesian high school environments regarding the dynamics of Fluency vs. Originality resulting from the adoption of AI Chatbots. The implications of the research show that the use of AI Chatbots directly forces teachers to adopt new assessment methods: emphasizing the process and justification of ideas, not just the final result. The practical implication is the need to adopt a structured pedagogical framework, such as the "Pedagogy of Wonder," to ensure that AI Chatbots function as catalysts for deep and ethical exploration of ideas, rather than as substitutes for student thinking.

Future research recommendations from these findings are highly relevant to support the implementation of the Coding and Artificial Intelligence Curriculum policy in Indonesia (Ministerial Regulation No. 13 of 2025). These findings provide a scientific basis for formulating AI literacy strategies that focus on: (1) Training teachers to design activities that require sophisticated prompting and (2) Ethics education to distinguish between human originality and machine-generated pseudo-originality. Thus, AI chatbots are seen not as the end of creativity but as a gateway to more integrated creative expression, which requires a balance between technological efficiency and the uniqueness of human thought.

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