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The Influence of AI Phenomenon on Creativity and Problem Solving Skills in Urban and Rural SMK Teacher

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Abstract: This study aims to analyze the effect of artificial intelligence (AI) phenomenon on the creativity and problem-solving skills of vocational teachers in urban and rural areas. Entering the digital age, AI has the potential to become an important instrument in vocational education, both in enhancing personalized learning and bridging the digital divide, especially between urban and rural schools. The population of this study was teachers of SMK Engineering Study Program in Surabaya (urban) and Bojonegoro (rural), with a total sample of 100 teachers, 50 teachers each from both regions. MANOVA was used to analyze the effect of AI as a predictor of creative thinking and problem solving skills, as well as the moderating effect of school environment between urban and rural areas. The results showed that AI had a significant effect on improving creativity and problem-solving ability in vocational school teachers, with notable differences between urban and rural areas. Teachers in urban schools showed greater improvement in creativity, while rural teachers were helped more in problem-solving ability with the help of AI.

INTRODUCTION

The impression In the digital era, the integration of Artificial Intelligence (AI) into education has opened a new era characterized by unprecedented possibilities and challenges (Shrungare, 2023). Among the many aspects of education that are undergoing transformation, the intersection between AI, creativity, and problem-solving is an area that has great potential. This phenomenon has a special meaning for vocational schools, institutions in charge of preparing students to apply knowledge practically and practically (Zhu & Ren, 2022). As we delve into the differences between vocational schools in urban and rural areas, it becomes clear that the impact of AI on creativity and problem-solving is diverse and diverse.

Artificial intelligence, with its ability to mimic human intelligence, has spread to various sectors, including education. The application of AI in educational environments ranges from personalized learning platforms to adaptive assessments, which offer customized experiences for students based on their unique needs and learning styles (Altarawneh, 2023). In the field of vocational education, where the emphasis is on equipping students with practical skills for specific fields, AI provides opportunities to improve traditional teaching methods and foster a more dynamic and responsive learning environment (Wang et al., 2023). Creativity and problem-solving are fundamental pillars

of vocational education, bridging the gap between theoretical knowledge and its practical application (Chang, 2013). In vocational schools, students are not just recipients of information; They are future professionals who must face real-world challenges with ingenuity and adaptability. AI has the potential to be a catalyst in developing these important cognitive skills by providing new learning experiences and innovative problem-solving scenarios (Zhu & Ren, 2022).

In urban vocational schools, where access to technology is often more common, the integration of AI into the curriculum faces challenges and opportunities. On the one hand, the abundance of resources and technological infrastructure provides a conducive environment for the application of AI-based educational tools (Cheng, 2010). On the other hand, fast-paced urban life can raise concerns regarding the potential dehumanization of education and the need for a balance between the integration of technology and a human-centered pedagogical approach. AI can bring a paradigm shift in the way urban vocational schools approach creativity and problem-solving (Chen et al., 2023). Intelligent tutoring systems can tailor lessons to each student's needs, allowing for personalized skill development. Virtual simulations and augmented reality applications can bring students into real-life scenarios, providing hands-on experiences that mirror real-world challenges. However, urban conditions also highlight the problems of accessibility and equality, as not all students have the same access to cutting-edge technology, potentially exacerbating existing educational gaps.

In rural vocational schools, AI integration faces different challenges and opportunities. Limited access to technology and the potential for a digital divide can pose obstacles to the smooth implementation of AI-based educational tools (Bairagya, 2021). However, the unique characteristics of rural communities, such as a close-knit social structure and a focus on hands-on learning, can be leveraged to create innovative approaches to AI integration (Maksum et al., 2023). Vocational schools in rural areas can benefit from the application of AI that meets the specific needs of their communities. Adaptive learning platforms can be designed to accommodate different levels of technology infrastructure, ensuring that even schools with limited resources can access the benefits of AI-based education. Additionally, AI can facilitate distance learning opportunities, connecting students in rural areas with expert instructors and resources that may not be physically available around them (Simões & Brito do Rio, 2020).

As AI becomes more prevalent in vocational education, a balance between technological innovation and the human touch is crucial (Cai, 2022). The role of educators evolves from traditional knowledge transmitters to facilitators of dynamic learning experiences. In both urban and rural areas, teachers become regulators of AI-based tools, guiding students through interactive learning modules, and interpreting the insights generated by AI algorithms to tailor their learning approaches. On the road to the effective integration of AI into vocational education, a proactive strategy is essential. Professional development for educators, who focus on AI literacy and the effective use of AI tools, is paramount. Collaboration between educational institutions, policymakers, and industry stakeholders is essential to align AI-based curricula with the demands of the ever-evolving job market. Additionally, targeted investments in technology infrastructure, especially in

rural areas, can help bridge the digital divide and ensure equitable access to AI-based educational resources.

In summary, there are two main objectives of this study, the first is to find out whether AI is a unique predictor for the exploration of creative thinking and problem solving. Our second goal is to test this relationship in a cultural context by exploring the moderation effects of the geography of the school environment (Urban and Rural).

The application of AI in education is growing rapidly. AI can be used for a variety of purposes, such as personalization of learning, assessment, and learning support. Creativity and problem-solving skills are important skills for teachers in the digital era. AI can help teachers develop these skills by providing new tools and resources. There are differences in access to technology and infrastructure, education and knowledge in rural areas are still lagging behind compared to urban areas. This can lead to gaps in teachers' learning and professional development. The novelty of this research will examine the phenomenon of AI in relation to creativity and problem-solving abilities in vocational school teachers in urban and rural areas. The study will also compare and analyze how AI is used by teachers in the two regions.

METHOD

This study uses a quantitative research design with a descriptive-comparative approach. This design was chosen because this study aims to determine the relationship between the AI phenomenon and creativity and problem-solving skills in vocational school teachers in urban and rural areas. The population of this study is vocational school students in Surabaya and Bojonegoro, East Java. The sample of this study was 100 teachers of the Engineering Study Program, with 50 teachers from vocational schools in Surabaya and 50 teachers from vocational schools in Bojonegoro. Samples were selected using the purposive sampling technique. The research data was analyzed using multivariate analysis of variance (manova). In research on creativity and problem-solving, manova analysis can be used to test whether there are significant differences between urban and rural vocational schools on variables. The research steps used in this study are, as follows:

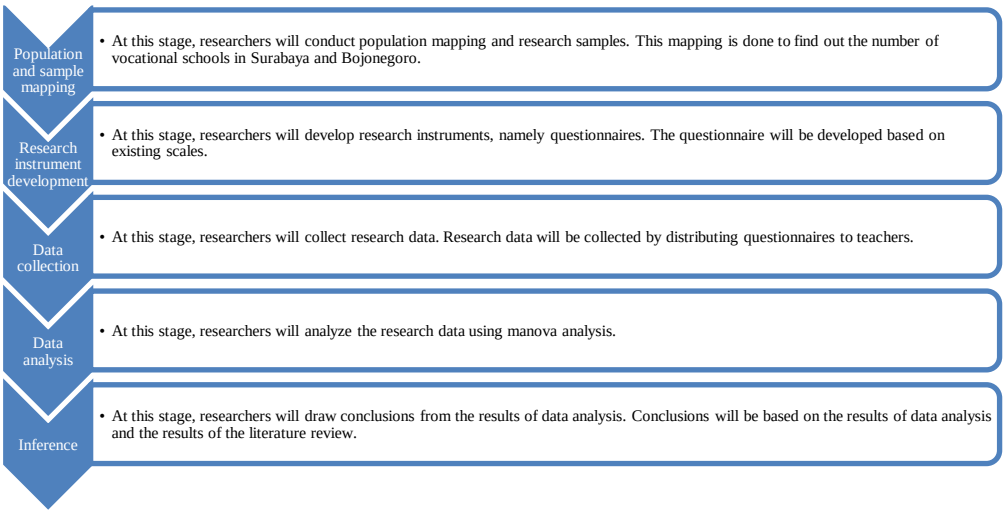

Figure 1. Research Steps

RESULT AND DISCUSSION

This study aims to analyze the influence of artificial intelligence (AI) phenomena on creativity and problem-solving abilities in vocational school teachers in urban and rural areas. The development of this research instrument was developed based on the Torrance Creative Thinking Test Scale, This test measures various aspects of creativity, such as fluency, flexibility, and originality. Creativity Assessment Scales (CAS) to measure four aspects of creativity: idea, flexibility, elaboration, and originality. Problem Solving Inventory (PSI), measures four aspects of problem-solving ability: problem definition, solution generation, solution selection, and solution implementation. The development of the instruments used is as follows.

Table 1. Research Indicators

Variable	Indivator
Creativity	Fluency
	Flexibility
	Originality
	Idea
	Elaboration
Problem Solving	Problem Definition
	Solution Generation
	Solution Selection
	Solution Implementation
AI	Integration AI

Next is the data analysis process, after the questionnaire is distributed to a total of 100 teachers who are divided between urban teachers, namely the city of Surabaya and rural teachers, namely Bojonegoro. The results of the analysis are as follows:

Table 2. Desciptive Analysis

Item	Urban Mean	Urban SD	Rural Mean	Rural SD	Total Mean	Total SD	N
Q1_Fluency	3.50	0.505	2.38	0.490	2.94	0.750	100
Q2_Flexibility	3.44	0.501	2.58	0.499	3.01	0.659	100
Q3_Originality	3.52	0.505	2.36	0.485	2.94	0.763	100
Q4_Idea	3.58	0.499	2.58	0.499	3.08	0.706	100
Q5_Elaboration	3.46	0.503	2.56	0.501	3.01	0.674	100
AVE_Creativity	3.50	0.2499	2.492	0.2107	2.996	0.556	100
Q6_Problem_Definition	3.58	0.499	2.42	0.499	3.00	0.765	100
Q7_Solution_Generation	3.56	0.501	2.44	0.501	3.00	0.752	100
Q8_Solution_Selection	3.56	0.501	2.60	0.495	3.08	0.692	100
Q9_Solution_Implementation	3.48	0.495	2.66	0.501	3.03	0.611	100
AVE_PS	3.55	0.2685	2.53	0.2294	3.03	0.558	100
Q10_AI_Effect	3.52	0.505	2.50	0.505	3.01	0.718	100

Based on table 6, it shows that the average difference in the influence of AI in the creativity and problem-solving abilities of teachers of rural and urban vocational schools. On the fluency indicator, which reflects the ability of an individual to generate a large number of ideas in a short period of time. From the table, it can be seen that the average subjects in urban areas have a higher fluency score of 3.50 compared to subjects from rural areas of 2.38. Flexibility of thinking reflects the individual's ability to change the approach or perspective on a problem. The average flexibility of respondents in urban areas was

3.44, higher than in rural areas which was only 2.58. Originality is the ability to generate ideas that are unique and different from those that already exist. From the results of the analysis, individuals in urban areas showed a higher originality score of 3.52) compared to those in rural areas of 2.36. In terms of the ability to develop ideas, subjects from urban areas again showed an advantage with an average of 3.58, much higher compared to subjects in rural areas who only reached 2.58. Elaboration reflects a person's ability to develop an idea in detail and depth.

From table 2, it can be seen that respondents in urban areas have a higher elaboration ability of 3.46 compared to respondents in rural areas of 2.56. The average total creativity in urban areas is 3.50, while in rural areas it is only 2.49. This shows that in general, the level of creativity in urban areas is much higher compared to in rural areas. Urban respondents also excelled in defining problems, with an average score of 3.58, compared to 2.42 in rural areas. The ability to generate solutions is also higher in urban 3.56 compared to rural 2.44. The ability to choose the best solution is also higher in urban 3.56 compared to in rural 2.60. Urban respondents were also better at implementing solutions with an average of 3.40 compared to 2.66 in rural areas. The average problem-solving ability in urban areas reaches 3.5250, while in rural areas it is only 2.5300. The study also assessed the effects of artificial intelligence (AI) on creativity, and the results showed that respondents in urban areas felt more positively impacted by AI on their creativity with an average of 3.52, compared to 2.50 in rural areas. Overall, the results of this study showed significant differences between urban and rural respondents in terms of creativity and problem-solving.

After conducting statistical descriptive analysis, the next step is to conduct a manova test to test the mean differences of several dependent variables (in this case, creativity and problem solving) simultaneously between two independent groups, namely teachers working in urban and rural areas.

Table 3. Analysis Manova

Effect	Statistic	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.997	3159.279	10.000	89.000	0.000
Intercept	Wilks' Lambda	0.003	3159.279	10.000	89.000	0.000
Intercept	Hotelling's Trace	354.975	3159.279	10.000	89.000	0.000
Intercept	Roy's Largest Root	354.975	3159.279	10.000	89.000	0.000
Location	Pillai's Trace	0.910	90.325	10.000	89.000	0.000
Location	Wilks' Lambda	0.090	90.325	10.000	89.000	0.000
Location	Hotelling's Trace	10.149	90.325	10.000	89.000	0.000
Location	Roy's Largest Root	10.149	90.325	10.000	89.000	0.000

Based on the results of this MANOVA analysis, it can be concluded that there are significant differences between teachers in urban and rural areas in terms of creativity and problem-solving skills under the influence of artificial intelligence (AI) phenomena. The values of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root all show very high significance, meaning that location, as an independent variable, substantially affects the dependent variables (creativity and problem-solving).

The main focus of table 3 is the influence of location, i.e. Educational Educators who categorize teachers based on their teaching places (urban vs. rural). This location variable

was tested to see if there was a significant difference between teachers working in urban and rural areas in terms of creativity and problem-solving abilities under the influence of AI phenomena. The table shows the significant values for all multivariate tests associated with Location Educators. Pillai's Trace for Location Educators shows a value of .910 with an F value of 90.325, as well as a significance of p = .000. This suggests that about 91% of the variation in creativity and problem-solving ability can be explained by location differences. This reinforces the initial suspicion that there is a significant difference between urban and rural teachers in utilizing AI to support creativity and problem-solving. Wilks' Lambda of .090 also confirmed that there was a significant difference between groups, with this number close to 0, meaning that the difference between groups (urban and rural teachers) was very large and endemicly significant. Hotelling's Trace and Roy's Largest Root, both valued at 10,149 with a very strong significance level (p = .000). This test shows that location endemic (urban vs. rural) has a very large and significant effect on teachers' creativity and problem-solving.

These results are in line with the previously described descriptive findings, where teachers in urban areas tend to have higher scores in creativity and problem-solving compared to teachers in rural areas. One possible explanation is that teachers in urban areas have better access to AI-based technologies, which can support their ability to be more creative and effective in problem-solving. On the other hand, the limitations of technological infrastructure in rural areas can affect the ability of teachers there to make optimal use of AI technology, which in turn affects their creativity and problem-solving abilities.

The results of this MANOVA test provide empirical support for the hypothesis that location (urban vs. rural) plays an important role in determining the extent to which teachers can utilize AI to improve their creativity and problem-solving abilities. In the context of endicit policies, these results show the importance of providing equal access to technology, especially AI-based technologies, across regions, both urban and rural. This is important so that all teachers, regardless of location, can take advantage of modern technology to support a more innovative and effective learning process.

Table 4. Between Subject Analysis

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Q1_Fluency	31.360	1	31.360	126.577	0.000
Q2_Flexibility	18.490	1	18.490	73.960	0.000	
Q3_Originality	33.640	1	33.640	137.363	0.000	
Q4_Idea	25.000	1	25.000	100.575	0.000	
Q5_Elaboration	20.250	1	20.250	80.788	0.000	
AVE_Creativity	25.402	1	25.402	475.358	0.000	
Q6_Problem_Definition	33.640	1	33.640	135.333	0.000	
Q7_Solution_Generation	31.360	1	31.360	125.440	0.000	
Q8_Solution_Selection	23.040	1	23.040	92.842	0.000	
Q9_Solution_Implementation	30.010	1	30.010	124.991	0.000	
AVE_PS	24.751	1	24.751	396.901	0.000	
Q10_AI_Effect	26.010	1	26.010	102.041	0.000	
Intercept	Q1_Fluency	864.360	1	864.360	3487.868	0.000
Q2_Flexibility	906.010	1	906.010	3624.040	0.000	
Q3_Originality	864.360	1	864.360	3549.470	0.000	

Q4_Idea	948.640	1	948.640	3822.860	0.000	
Q5_Elaboration	906.010	1	906.010	3588.884	0.000	
AVE_Creativity	897.602	1	897.602	16796.858	0.000	
Q6_Problem_Definition	900.000	1	900.000	3629.669	0.000	
Q7_Solution_Generation	900.000	1	900.000	3602.859	0.000	
Q8_Solution_Selection	948.640	1	948.640	3825.849	0.000	
Q9_Solution_Implementation	918.090	1	918.090	3874.798	0.000	
AVE_PS	916.576	1	916.576	14698.708	0.000	
Q10_AI_Effect	906.010	1	906.010	3554.403	0.000	
Location	Q1_Fluency	31.360	1	31.360	126.577	0.000
Q2_Flexibility	18.490	1	18.490	73.960	0.000	
Q3_Originality	33.640	1	33.640	137.363	0.000	
Q4_Idea	25.000	1	25.000	100.575	0.000	
Q5_Elaboration	20.250	1	20.250	80.788	0.000	
AVE_Creativity	25.402	1	25.402	475.358	0.000	
Q6_Problem_Definition	33.640	1	33.640	135.333	0.000	
Q7_Solution_Generation	31.360	1	31.360	125.440	0.000	
Q8_Solution_Selection	23.040	1	23.040	92.842	0.000	
Q9_Solution_Implementation	30.010	1	30.010	124.991	0.000	
AVE_PS	24.751	1	24.751	396.901	0.000	
Q10_AI_Effect	26.010	1	26.010	102.041	0.000	

The results of the advanced analysis displayed in the table "Tests of Between-Subjects Effects" revealed the impact of location (urban and rural) on the creativity and problem-solving abilities of vocational school teachers in the context of the influence of artificial intelligence (AI) phenomena. This analysis involves an ANOVA test for each dependent variable, consisting of fluency, flexibility, originality, idea generation, elaboration, problem definition, solution generation, solution selection, and solution implementation, as well as perception of the influence of AI (AI effect).

The first line of each variable shows the result for the Corrected Model, which provides information about the overall model being tested. The high F value and significance of p = .000 for all dependent variables confirm that the model is able to predict creativity and problem-solving ability well. The highest F value was seen in the Fluency variable (F = 126,577), which shows that this model is very effective in predicting the teacher's fluency in solving problems. The same is true for other dependent variables, all of which show that the model substantially affects creativity and problem-solving outcomes.

In the Intercept section, a very large F value 3487.768 for Fluency indicates that the dependent variables have a very high base value. In other words, the creativity and problem-solving abilities in teachers, in general, are strong enough even before location variables are taken into account. This indicates that teachers in general already have high potential in the aspects of creativity and problem-solving, but the location in which they teach may affect how far they can develop that potential.

The main focus of this study is how location affects creativity and problem-solving ability in teachers. The ANOVA results show that location (urban vs. rural) has a significant influence on almost all dependent variables, as indicated by a statistically significant F value (Sig = .000) on each row of dependent variables in the "location" section. In Fluency, location showed a significant influence with a value of F 126.577. This

means that teachers in urban areas are more capable in terms of fluency when facing problems compared to teachers in rural areas. This may be due to the difference in access to technology and information, where teachers in urban areas are more exposed to AI-based technology that allows them to think more fluently and quickly in formulating solutions. Flexibility also showed a significant difference with F 73,960, which showed that location played a role in determining teachers' flexibility in changing their approach to a problem. Urban teachers tend to be more flexible in solving problems than rural teachers, which may be due to their exposure to a variety of AI tools that make it easier to adapt to different approaches.

In Originality and Idea, the difference between urban and rural teachers was also significant, with F grades of 137,363 and 100,575, respectively. This indicates that teachers in urban areas are superior in terms of the authenticity of ideas and the generation of ideas. Better access to AI resources allows them to think more innovatively and generate new ideas in the learning process. Two combined variables, AVE_Creativity and AVE_PS (problem-solving), provide an overall picture of a teacher's creativity and problem-solving abilities. The value of F = 475,358 for AVE_Creativity and F = 396,901 for AVE_PS indicates that location has a very significant influence on creativity and problem-solving ability. Urban teachers, who are more exposed to AI and other innovative technologies, appear to have higher creativity and are better able to solve problems effectively than rural teachers.

One of the important studies that is in line with these results is a study conducted by Marzuki et al. (2023), which examined the role of AI in increasing creativity in the educational environment. This study finds that the use of AI in learning has the potential to stimulate teachers' creativity, especially by providing tools that facilitate the exploration of new and innovative ideas. Teachers who use AI tend to be more capable of generating unique and varied ideas, which is also reflected in the results of this study, where teachers in urban areas, who are more often exposed to AI technology, have a higher level of creativity than teachers in rural areas. In addition, the integration of AI technology into the learning process allows teachers to be more creative in designing and implementing learning activities. AI provides a variety of resources and information that broaden teachers' horizons, so that they are better able to produce original solutions to problems faced in the learning process. This study supports the results of research that shows the influence of location on creativity, where teachers in cities, with better access to AI, tend to be more creative in (Ali et al., 2024).

There is a significant gap between access to technology in urban and rural areas, where teachers in rural areas often face limited technological infrastructure. This limitation not only limits the use of AI in learning, but also hinders the development of creativity and problem-solving skills. The study supports the finding that teachers in rural areas show lower performance compared to urban teachers in terms of creativity and problem-solving skills, mainly due to limited access to technologies such as AI (Wang et al., 2021). While there is great potential for AI technology to support learning, geographical and economic differences often lead to inequalities in its use. Teachers in rural areas generally do not have adequate training or easy access to AI devices, which makes it difficult for them to

optimize the potential of technology in supporting their teaching. This study reinforces the results that location differences have a significant impact on creativity and problem-solving skills in teachers (Molefi et al., 2024).

AI has great potential to support learning, teachers in rural areas often do not have adequate technical support to utilize this technology effectively. In addition, the limitations of technological infrastructure in rural areas are also a major obstacle to AI adoption. This leads to significant differences between teachers in urban and rural areas in terms of creativity and problem-solving abilities (Kamalov et al., 2023).

CONCLUSION

This study aims to explore the influence of artificial intelligence (AI) phenomena on creativity and problem-solving abilities in vocational school teachers in urban and rural areas. Based on the results of the research that has been conducted, it is found that AI has a significant impact on both variables, although there are striking differences between teachers working in urban and rural areas. This difference is especially noticeable in terms of creativity, where teachers in urban areas show higher scores compared to teachers in rural areas. This can be attributed to wider access to technology, including AI, in urban areas, which helps teachers develop creative thinking skills such as fluency, flexibility, originality, and idea generation. The use of AI in the learning process in urban areas allows teachers to think innovatively, generate new ideas, and solve learning problems in a more creative way.

In contrast, teachers in rural areas who have limited access to AI technology show lower creativity scores. However, what is interesting about this study is the finding that AI still makes a significant contribution to improving problem-solving skills in teachers in rural areas. Although the creativity of teachers in rural areas is lower than that of teachers in urban areas, the results of the study show that their ability to solve problems is quite good. Their problem-solving scores were relatively higher compared to creativity scores, which indicates that despite the limitations of technology in rural areas, AI is still able to help teachers solve learning problems in a more structured and efficient way.

The problem-solving ability of teachers in rural areas is helped by AI, especially in aspects such as problem definition and solution generation. AI provides support to teachers in rural areas by helping them define problems more clearly and in a structured way, and offers a variety of alternative solutions that can be directly applied in the learning process. With the help of AI, these teachers are able to solve learning problems in a more effective way even though limited access to technology is still a challenge. This shows that AI technology plays an important role in improving the quality of education, especially in helping teachers solve problems in environments with limited technological resources.

Overall, the results of this study indicate that AI has a significant influence on the creativity and problem-solving abilities of vocational school teachers, both in urban and rural areas. Teachers in urban areas benefit more from AI in terms of creativity, because urban environments are more conducive to technological development, while teachers in rural areas are more helped by AI in improving their problem-solving skills. This shows that while AI has a positive impact in both contexts, the impact is different according to

local conditions. Teachers in rural areas are more helped in the aspect of problem-solving, which can be seen from their higher problem-solving scores compared to creativity scores.

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