THE MOST POPULAR ARTIFICIAL INTELLIGENCE APPLICATION USED BY AEROSPACE ENGINEERING STUDENTS' TO LEARN MATHEMATICS

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Abstract — *Artificial intelligence (AI) develops over time. Education is concurrently the AI evolution, sometimes in front, sometimes behind. Education underlies AI, and later on, AI is used in education. Therefore, the utilization of AI in education cannot be denied. There are many advantages, but also some limitations and ethical issues that arise from the use of AI in education. There are many applications of AI in mathematics scattered throughout society, but not all of them are useful enough. Thus, the purpose of this research is to gain the famous application AI in mathematics (app AI math) that is mostly used and recommended by the students' experience in doing and learning mathematics. T-test independent samples were used to test the score of two groups, using the AI math app or not, in order to know whether it was affected or not. The result of this research is that the most popular app is Photomath, followed by ChatGPT and Mathway. But still, many students did not use this app. Relating to their score, the students who have used the AI math app to learn math before are not different from the students who do not use the AI math app.*

Keywords: Artificial Intelligence (AI), application, mathematics, aerospace engineering students

1. INTRODUCTION

Artificial intelligence (AI) in education has been known since 1991 [1]. This synergy of AI in education is in line with the development of AI techniques for the study of human teaching and the enginee ring of systems that facilitate human learning [1]. Year by year, the AI that can be used for teaching and learning is growing rapidly. According to Education Week, 58% of high school students have used generative artificial intelligence (AI) before [2] to understand their school materials. The AI that is used in schools nowadays is heterogeneous, not only for language or theoretical subjects but also for calculations like mathematics. For exam ple, AI that is *used for mathematics such as Geogebra was launched in 2001, Mathway in 2002, Bing and Wolfram Alpha in 2009, Desmos in 2011, Brainly in 2013, Photomath in 2014, Qanda in 2016, Chat GPT in 2022, and the newest one is Google Bard in 2023. All of these AIs are built for smartphone applications. So, students can easily use it whenever and wherever they are using their smart phones. The works of these appli cations are almost the same; they help find solutions to mathematics problems or questions. Some difference is in how to input the problems; there is an application that already uses the phone's camera to recognize math equations and display a step-by-step solution on screen, like Photomath. Others applications have to*

input the problems by texting using the computerized mathematics symbol ^, which represents exponential. Since the widespread use of AI among students and the affection of Pandemic COVID-19, which is forcing everyone to have digital literacy, most of the research about the use of the newest AI applications has been done. Most of them found that AI is something that promises to help students' understanding, especially in mathe matics. [3]–[5] But some research still exhibits the limitations of AI in the teaching-learning process for students. However, there is a lack of research systematically investigating the effects of students who have used generative artificial intelligence or not. Therefore, this research tries to fill this gap. For this, we will analyze what kinds of AI applications the aerospace engineering students have generatively used and how their test scores compare with those of the students who do not use or do not prefer to use AI applications in learning mathe matics.

2. THEORETICAL BACKGROUND

2.1. Artificial Intelligence in Education

In an age of rapid technological growth, artificial intelligence (AI) has the potential to transform industries, with education at the leading edge of this transformation [6]–[8]. Artificial intelligence is utilized to assist the teacher's teaching process, improve the students' learning process, and encourage the change of the educational system [9]. AI has enormous revolutionary implications, including per sonalizing learning experien ces and changing instructional approaches to optimize administrative operations. The integration of artificial intelligence for the teaching and learning of mathematics prog rams in higher education institutions will support the presentation of mathematics lectures, examining the mathematics students' reports, the construction of instructional resources for mathematics, and others. [4]. However, ethical concerns are also brought to the forefront, seeking a balanced approach between the prior knowledge and the new knowledge from AI [6], [10]. The prior knowledge students' highly correlates with AI awareness and AI skills level of competence of students [10]. Using AI without prior knowledge will lead to incomprehension for the students. Copying and pasting the answer will then be their shortcut. Therefore, as education transitions into the digital era, educators, policymakers, and stakeholders defining the future of learning must also comprehend the consequences of AI integration.

2.2. Artificial Intelligence Application for Mathematics

Artificial intelligence (AI) is widely used daily. AI is being actively and expected to be effectively used in many fields of education, one of which is mathematics. Artificial intelligence can answer mathe matical problems and expressions. Many AIs that can support the mathe matics learning process are launched nowadays by applications installed on smartphones or websites accessed. Furthermore, chatbots such as ChatGPT, Google Bard, Bing Chat, and Wolfram Alpha are well-known for improving math skills and assisting students at all levels. Students investigate this AI tool by providing basic to expert knowledge and information on a variety of math topics, as well as detailed training and assistance with geometry. Thus, chatbots such as ChatGPT, Google Bard, Bing Chat, and Wolfram Alpha can handle essential aspects of mathematics such as equations and expressions. In contrast, a chatbot like this can perform basic mathematical operations like addition, subtraction, multiplication, and division. ChatGPT can be a powerful instrument for mathematics education since ChatGPT, Google Bard, and Bing Chat can generate tailored feedback, explain mathematical ideas, and assist students with problem solving [11]. AI chatbots, including Google Bard, Chat GPT, Bing Chat, and Wolfram Alpha, have demon strated tremendous potential for tackling mathematical algorithm issues [12]. They

can analyze and generate mathematical equations, offer step-by-step answers, and improve student learning experiences. However, obstacles like a poor grasp of natural language models, difficulty solving complex problems, and potential prejudice will arise. Mathematics can also help us realize the limitations of artificial intelligence. For example, mathe matics can be used to demonstrate that some issues are impo ssible for AI to solve. Since some AI periodically fail and make mistakes in public, these stumbles act as stepping stones to success [13].Actually, most of them are used by students just to solve the mathe matics problems at the school. Just a few students really use this application to enhance their under standing of the concept of the material. It can be proven when you are seeing students' works that they are just copying exactly what is written from the appli cation towards the problem they have to solve without correcting the notation or symbols from the computer language to the correct mathematical notation or symbols.

Table 1. *Questionnaire result about favourite Applications AI math students used*

No	Name	Installed App in Smartphone	AI Website	Most Fav App
1	Bing	2	1	2
2	Brainly Default	2	5	2
3	Calculator	15	9	6
4	Chat GPT	3	6	7
5	Desmos	0	1	1
6	Geogebra	1	1	1
7	Google Bard	1	3	2
8	Math Editor	1	0	1
9	Mathway	4	3	6
10	Matlab	0	8	5
11	None	8	33	12
12	Photomath	40	7	31
13	Qanda	3	1	4
14	Question AI	3	3	2
15	Wolfram Alpha	0	1	1
16	Youtube	0	1	0
		83	83	83

3. RESEARCH METHODOLOGY

This is quantitative research using two independent sample t-tests to compare the variance of two groups of aerospace engineering students at a private university in Yogyakarta [14]. The first group is the students who have generatively used AI applications to learn mathematics; the second is not preferred. We will compare the middle test scores of these students. There are 83 students participating in these experiments. They also gave the question naire to determine the spread of application use among students.

4. RESULT AND DISCUSSION

The questionnaire is analysed using Microsoft Excel to describe the data centra lization and dispersion and also making the graph of the data.

There are three questions related to the use of AI applications in mathematics that students use nowadays. From the first question about what kind of application students have installed in their smartphone that they are using for doing or under standing mathematics, most stu dents chose photomath, followed by Calculator (smartphone default), and did not install any mathematics applications in their smart phone. Meanwhile, for the second question that asked about AI websites that are usually used to help students practice mathe matics problems, surprisingly, 33 of the 83 students answered that they do not use any AI websites to solve mathematics problems. Believe it or not, it could happen since students are always more dependent on their smartphones than computers or laptops. Therefore, they might rarely open a website, just using what their smart phones could do. But they still use calculators on websites; it might be a website that names

calculators on something like an integral calculator, a calculator matrix, etc. So they think it was a calculator rather than an AI application. Watching videos on YouTube is also considered by them as an application to help them learn mathematics since some lecturers already have YouTube accounts that provide students with videos like repetition of teacher explanations in the classrooms [15]. The third question, asking for the recommended applications of students that can support their learning progress in mathematics on campus, makes photomath first in the students' hearts. From Table 1, we can see that there are three applications that are mostly mentioned by students: photomath, chatgpt, and mathway. Thus, these three applications must be famous among them; see the logo on picture 1 below.


Picture 1. The First Three Famous App among students (from left-to-right Photomath, ChatGPT and Mathway)
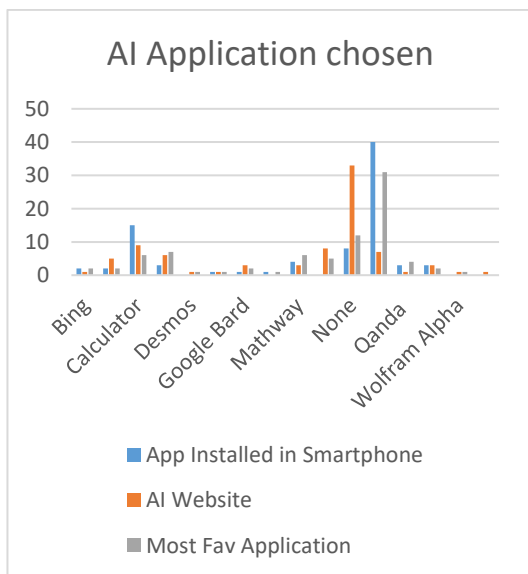
Picture 2. Bar Chart about AI Application use and recommend by students to learn mathematics

It is found from picture 2 that the most used and favorite AI application by these students is photomath. Other AI appli cations are also famous but not as significant or make an impression on students. Why is it so? This question could be answered by analyzing how these appli cations solve problems one-by-one, then comparing them to know which one is the better one or to prove why our students prefer Photomath over others, and this will become the basis for further research purposes. Furthermore, since the second questionnaire found the unpredic table result that most students did not use AI websites but some of them still use AI applications installed, we are curious about the impact on students' comprehension. Also, when we analyzed the students' consistency when answering the names of applications, we found from the question naires that 75% of students did not mention the same application for the three different questions in picture 3 below.
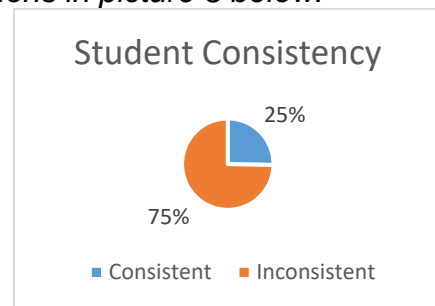
Picture 3. Student consistency of mentioning application name

Thus, we did independent t-test sample from the students' mathematics score. We pick the students' score based on the Table 2. before

Table 2. The students' consistency answer

Group	Criteria	Number	Total
Group 1 (generative use app AI Math)	The recommended app is same with what installed in smartphone	37	= 59
	The recommended app is installed in smartphone and not	12	

		mentioned in web			
		The recommended app is mentioned in web	10		
		The recommended app is NOT installed in smartphone and NOT mentioned in web	13		
Group 2 (do not use App AI Math)				$= 24$	
		No recommended app	11		

Building on that groups, the statistics result of t-test independent sample is below. Using the null hypothesis H_0 assume that there is no difference on students' average score, with significance level $\alpha = 5\%$.

We used t-test independent sample since the sample one of group is less than 30.

In this case, we assume;

- $H_0: \mu_1 = \mu_2$ there is no difference on means between group 1 and group 2
- $H_1: \mu_1 \neq \mu_2$ there is difference on means between group 1 and group 2

Table 3. Group Statistics

	code	N	Mean	Std. Deviation	Std. Error Mean
Test score	1	24	45.50	17.103	3.491
	2	59	48.08	19.577	2.549

When we check the simple calculation in Table 3, we can see that the mean is not really diverse. It is just 3 points different in line with their deviation, which is 2.5 points different. But to make sure, we have to check the statistical test using t-test methods from Table 4 below.

Table 4. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Test score	Equal variances assumed	.325	.570	-.565	81	.574	-2.585	4.578	-11.693	6.523
	Equal variances not assumed			-.598	48.57	.553	-2.585	4.323	-11.273	6.104

Based on Levene's test, the p-value (Sig) $= 0{,}570 > \alpha = 0{,}05$, means that H_0 which said that the variance of the population same is accepted. Therefore, it will assume that these two population has the same variance. Then for the t-test result we use the Equal Variances Assumed, the first row. Regarding to t-test, p-value (Sig) $= 0{,}574 > \alpha = 0{,}05$ which means that H_0 is accepted. The null hypothesis (H_0) said that there is no difference means between Aerospace Engineering Students' test score who generative used applications AI math with students who do not use applications AI math. Based on the results, much attention should be paid to how the AI will help students learn and understand mathe matics rather than just do mathematics. This research found there is no difference in the average score between students who have used generative applications of AI math and those who have not. The phenomenon that there are still many students who do not prefer to use AI might be caused by the fact that students are mostly aware of AI's impact on the ethical aspects of life and are aware of the risks, so they will likely be able to recognize the potential negative impacts of AI in their lives [12]. Although much research has argued that implementing AI can improve academic performance, it does not focus on the score but more on students' happiness, motivation, critical thinking, creativity, self-reflection, self-confidence, and so on [10], [16]–[18]. Most research recommends the use of AI in the teaching and learning process but also indicates its limitations and ethical issues [19]–[23]. However, there is still just a few studies that expose the way these applications of AI

math solve mathematics questions and check the accuracy of their answers with the theory [12], [24]. Since mathematics itself is the knowledge that develops the application, Therefore, mathematics itself can be used to understand and find the limitations of AI [12], [25].

4. CONCLUSION AND RECOMMENDATIONS

- *To sum up, according to the role of human educators, AI emphasizes that technology could, of course, support educators and students. Somehow, it is not about whether AI should be introduced into education since students will know AI by themselves, but rather about questioning How AI will help students understand their learning materials, when is the best time to use AI to help students master school lessons, by whom AI should be taught, what age is the best time to introduce AI in education, and for what purposes AI is used in education?*
- *In the future, we need an analysis of the way AI works or does not work to help students understand mathematics con cepts.*

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