



# Academic Performance of Science 10 Learners of Pangasinan School of Arts and Trades (PSAT) Through Artificial Intelligence (AI) Based Adaptive Learning Tools

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## Abstract

This study determined the relationship between the use of AI-based Adaptive Learning Tools and the academic performance of Science 10 Learners of Pangasinan School of Arts and Trade of Lingayen I District in Pangasinan I for the school year 2025-2026. It was rationalized to address the issues concerning the decline of science literacy among Filipino learners. Ten sections with 456 Grade 10 learners served as respondents of the study. A descriptive-correlative survey was used in the study. Statistical tools, including frequency, percentage, mean, and Pearson r, were used to analyze the data. The result of the study showed that the Grade 10 learners use AI-based Adaptive Learning Tools with the guidance of the teachers in their classes, although it happens only sometimes or once a week as an overall frequency of use. The learners' science academic performance, despite of non-fully integration of the AI learning tools in their science classes, improved. Furthermore, the study showed that there was a significant relationship between the academic performance of the science 10 learners and their use of AI-adaptive learning tools. Common problems encountered by the science teachers in teaching the subject using the AI tools were associated with resources and accessibility of the internet. A training workshop on the use of AI-based adaptive learning tools was proposed.

**Keywords:** *AI-Based Adaptive Learning Tools, Science Academic Performance, Grade 10, PhET Interactive Simulations, Molecular Workbench, Perplexity AI, Socratic by Google, Khan Academy, LabXchange, CK-12 (Flexi AI Tutor)*



Chapter 1  
**THE PROBLEM**

**Rationale**

Today, we cannot expect our life without science and technology revolving around it every single second! Science and technology are extremely essential in our everyday life as they have made things more simple, fast and secured (Konar, 2024). Almost everything around is the gift of science and technology. Be it the smart-phones, fan, wheel, vehicles, cloth, paper, toothbrush, electricity, microwave, vehicles, radio, television, laptops, etc., everything is the result of science and technology.

Science and technology have made an impact on the phenomenon of human social history and society in general (Tegegn, 2024). As a result, the industrial revolution, information communication technology and transportation technology, agricultural technology transformation, warfare technology progression, and changes in social values and social institutions are among the most significant changes. Revolutionary and evolutionary advancements in science and technology shaped the reconstruction of society's history from various periods in continues pattern.

The COVID pandemic and the climate change crises show us how important science and technology are for helping the world develop in a way that is good for every individual. But the learners today show that they are not as interested in science as they used to be; they are not doing as well in science as they should be, and they are not achieving as much as they should be according to Bernardo in 2023.

In the Program for International Student Assessment (PISA) 2018, the Philippines ranked near the bottom of the 79 countries and economies that joined the assessment (Calleja, 2023). Only 22% of the 7,233 15-year-old Filipino students marked a minimum level of competency or level 2 in the science literacy assessment based on the report of Organization for Economic Cooperation and Development (2019).

For these reasons, this study tries to seek possible means to address the issues concerning the decline of science literacy of the Filipino learners, which has great impact in everyone's life. Specifically, this study tries to look at the impact of AI in enhancing the science literacy of the learners of Pangasinan School of Arts and Trades.

AI in education is the process of integrating and applying Artificial Intelligence (AI) technologies within the classroom to enhance teaching and learning experiences (Top Hat, 2026). This multifaceted approach leverages AI algorithms and tools to analyze and interpret student data, personalize educational content, automate administrative tasks, and provide adaptive feedback. Using AI in education, similar to machine learning in education, allows instructors to identify struggling students and provide the tailored support required to minimize barriers to success. The AI in education refers to using technology to address cognitive, physical, academic, social and emotional factors that impact learning using the AI-adaptive learning tools.

UMU (2026) states that AI adaptive learning tools are a deal in education technology. They use intelligence to look at data and make the learning experience better for each student. They can change the content to help each student learn better. Whenever a student has trouble with something, the tool can give them help or make the next lessons easier. This way of learning helps students understand things better. They are more interested. In a company like UMU, these tools can make employee training better. They make sure each employee gets



training that is just right for their job and what they want to do in their career. AI adaptive learning tools are really good, at this. They help employees learn what they need to know. AI adaptive learning tools make learning for learners and employees.

AI-adaptive learning tools provide feedback, target exercises, and content that can help learners especially in subjects like Science, which can be really tough and require critical thinking. Many learners in Grade 10 at Pangasinan School of Arts and Trades struggle to perform in Science. Teachers have noticed that these learners often have trouble understanding Science concepts like motion, chemical reactions and genetics. They also see that learners are not very engaged during Science lessons and tend to memorize information of really understanding it. As a result, learners do poorly on problem-solving and application-based tests. The traditional way of teaching, which is often lectures might not be working well for these learners. Also, there might not be individualized instruction or resources to help learners learn in a way that works best for them. Now with AI-based adaptive learning tools, there is a chance to give learners content that is tailored to their needs and provide real-time feedback to help them overcome their challenges.

This idea is aligned to the Republic Act 10533 known as Enhanced Basic Education Act of 2013 specifically in its Section 5 under Curriculum Development which states that traditional methods of teaching may already less effective in this 21<sup>st</sup> century and that AI-based adaptive learning tools would be more effective to improve science learning. However, it is still unclear if using AI tools can really help improve Science grades among Grade 10 learners at Pangasinan School of Arts and Trades.

Soliman (2024) stated that Artificial Intelligence offers a lot of things for education, especially when it comes to making things personal and getting work done quickly. Artificial intelligence can make learning materials right for each student, which makes students more interested and helps teachers teach in different ways. Also, artificial intelligence can do jobs like grading papers and making schedules, so teachers have more time to talk to students and help them in a more meaningful way. For example, in the schools of the educational landscape, artificial intelligence tools can help with problems like too many students in a class and not enough teachers. By giving students help and telling them how they are doing, artificial intelligence can help make sure all students get a good education, even if they learn in different ways. Artificial intelligence can also help students learn about computers and technology, which is important when they grow up and have job needing a lot of technology. Artificial intelligence is really good at helping students learn about technology, so they are ready for a future where technology is a big part of everything.

Kabudi et al (2021) conducted a systematic mapping of AI-enabled adaptive learning systems presented in the literature using 147 studies published between 2014 and 2020. It was found that systems (adaptive learning system, intelligent mechanisms and adaptive learning platform) and frameworks for adaptive learning were the most proposed and utilized interventions for addressing the challenges faced by students and teachers. The importance of such systems has largely increased during the pandemic as they can assist teachers in maintaining high-quality teaching and learning and improving learning design in IT and IS education.

The study by Luyusen in 2025 showed that Artificial Intelligence can really make learning for each student. Artificial Intelligence is making a difference in the Asia-Pacific region and all around the world. New systems like Adaptive Learning Platforms and Systems Intelligent



Tutoring Systems and Personalized Learning Analytics are getting better and better. These systems use Artificial Intelligence to make sure each student gets the help they need. They make learning easier. Give teachers useful information to help their students.

Artificial Intelligence has become an important part of schools and universities these days. It helps students learn in a way that is tailored to them, which is called learning. This makes students more interested in what they're doing and they can get to educational resources more easily as seen in the work of Vieriu in 2025.

There were eight studies that showed Artificial Intelligence can really make a difference in how students do. These studies found that students who used Artificial Intelligence to help them learn did better than students who did not use it. They used tools like ChatGPT and other computer programs to make learning personal and fun. Students who used these tools did 15 to 35 percent better on their work finished tasks faster. Were happier with what they were doing. All of this shows that Artificial Intelligence is very good at helping students learn what they need to know and it can make a difference in schools and universities from kindergarten, to college as also noted by Kwak in 2025.

The study by Ateeq and others in 2025 showed that interactive AI tools and adaptive learning platforms and digital literacy have an impact, on student skills. This research shows how AI can really change education for the better, which is what we see happening around the world and it gives us a better understanding of what is happening in specific areas. It also gives policymakers and educators in the region some tips to think about.

In the study of Alenezi (2024), it was evident that the use of the proposed AI-based adaptive learning system brought about changes in the level of student engagement. The study established that the students in the treatment group perceived the content to be more relevant—as measured by student engagement on a 10-point scale. The engagement self-report survey included questions about the interest in the lessons, participation, learning motivation and effort for schoolwork. Hence, the enhancement of the student's attitudes and interests could be due to the utilization of an AI-based adaptive learning system that is more suitable and engaging for the learners.

The study by Retome found that computer-based learning tools are really good at helping students learn and understand its culture. The results showed that students did well in the language with scores ranging from okay to good. The study looked at areas of language skills and found that the computer-based tools worked well. One of the things about these tools is that they adjust to help each student learn at their own level. The interactive parts of the tools also kept students more independent and interested in learning. This helps students stay motivated to learn for a time. Using computers is best when it helps students practice and get feedback. It does not replace teachers. The study suggests that we should use computers to help students practice and get feedback. We should also make computers better at understanding context. Helping students be good at using digital tools can help us achieve the goal of providing quality education to all.

In the Philippines, people are just starting to look into how Artificial Intelligence can help with learning analytics. This is part of a trend that shows Artificial Intelligence can make instruction better for students in the country. Artificial Intelligence is very good, at helping to make learning personal for each student.

Maborang and his team in their 2025 study found that using AI tools in education really helps students learn better. They also noted that these tools make students more involved in class



by encouraging them to participate and work together. This involvement helps students interact meaningfully with the course material. Students also want to keep using AI tools because they're good at answering academic questions and helping students learn. To get the most out of AI in education over time it will be crucial to integrate these tools and provide proper support so that students can continue to succeed.

Jacob and Morales found out in their study in 2025 that Artificial Intelligence tools can really help make education better. They need to be used very carefully. However, science teachers have a lot of problems when they try to use Artificial Intelligence in their classes. One reason is that Artificial Intelligence tools are very expensive. This makes it hard for teachers to use them. The information that Artificial Intelligence tools provide is not always good or relevant. Another problem is that the students do not always have access to the technology they need. Sometimes they do not have the devices and sometimes the internet does not work. This makes it very hard for the teachers to use Artificial Intelligence tools.

Santos (2019) and Rivera (2020) identified teacher readiness and technical issues as major reasons for AI's lack of use in Philippine public schools. Other studies, like the ones done by Zhao and his team in 2020 and Khan and Zhou in 2021 also point out these problems. Teachers often do not get the training they need and have to pay a lot for tools that use Artificial Intelligence. Baker in 2021 and Tapan and James in 2020 showed that there is a difference between what teachers want to do with Artificial Intelligence and what they can actually do, which is why they think schools should have training programs that are well planned. Things, like how old teachers are and how long they have been teaching also affect how they use Artificial Intelligence. These studies show that we need to do a job of training teachers and getting them the tools they need to teach science.

These reviewed studies and literature provided a strong rationale to investigate the science academic performance of grade 10 in Pangasinan School of Arts and Trades through AI-based adaptive learning tools as this study seeks to determine how AI can be harnessed to improve learning outcomes in the local secondary education context.

### **Theoretical Framework**

The study is based on the Cognitive Learning Theory by Piaget from 1972 as cited by Kasneci (2023), who explained how AI tools could facilitate the learning and feedback. This Cognitive Learning Theory says that people learn by being active and doing things. The Cognitive Learning Theory is, about people learning by doing, which is what the study is looking at. They learn from what's around them. ChatGPT is a tool that helps people learn. It gives answers and explanations away. This helps people learn and understand things in Science.

The Constructivist Learning Theory is also important. This theory says people learn by doing things and thinking about what they did. They like to learn by trying to solve problems. They also like doing projects that are meaningful to them. People learn best when they try things. They think about what worked and what did not. The theory also says that projects must be important, to the learner.

Tools that use intelligence can help people learn in a way that is like this theory. These tools can give people simulations and exercises to do. They can also give people feedback that's just for them. This helps people learn at their pace. The Cognitive Load Theory says that people can only learn much at a time. If people are given much to learn they might get confused. Tools that use intelligence can help with this. They can give people information a little at a time. They



can also help people with problems. Give them feedback. This helps people learn without getting too confused.

The Self-Determination Theory says that people need to feel like they're, in charge of their learning. They need to feel like they can do things. They also need to feel like they are connected to people. Tools that use intelligence can help with this. They can let people learn at their pace.

In the Experiential Learning Theory, people learn Science by trying things out and thinking about what happened in Science. For example, people can learn by doing experiments and thinking about the results. Tools that use intelligence can help people learn Science.

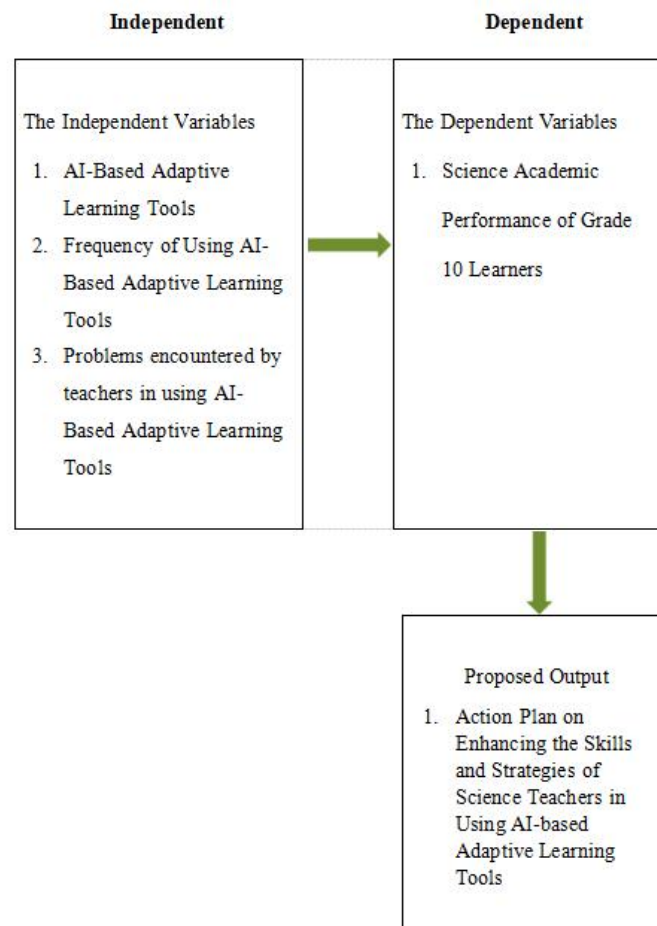
There is also the Technology Acceptance Model. This model says that people will use technology if they think it is useful and easy to use. ChatGPT is easy to use. It can help people learn Science. This might make people want to use it.

### **Conceptual Framework**

The study used the Independent-Dependent Conceptual Framework Model to show how the different parts are connected. First, it looked at the respondents regarding what AI-based adaptive learning tools they use and how frequent they use these tools. The science academic performance of the learners was also gathered to determine its relationship to the frequency of using AI-based adaptive learning tools. Then, the problems encountered by the science teachers in using the AI tools in teaching were also sought as bases in making an action plan. A questionnaire was made and distributed to the science teachers and grade 10 learners; collected the answers; and applied statistics to understand what the data mean.

### **Paradigm of the Study**

The causal paradigm of the study was presented in the three boxes as presented in the figure on the next page.



*Figure 1. Paradigm of the Study*

### Statement of the Problem

This study purposely determined the academic performance of science 10 learners of Pangasinan School of Arts and Trades through AI-based Adaptive Learning Tools. Specifically, the study sought answers to the following questions:

1. What AI-based adaptive learning tools do the grade 10 learners use;
2. How frequently do the grade 10 learners use AI-based adaptive learning tools;
3. What is the level of science academic performance of Grade 10 learners in third and fourth quarters;
4. Is there a significant relationship between the frequency of use of AI-based adaptive learning tools and the science academic performance of Grade 10 learners;
5. What are the problems encountered by the science teachers in teaching using the AI-based adaptive learning tools; and
6. What action plan can be proposed using AI-based adaptive learning tools to help enhance the academic performance of Grade 10 learners in science?



### Research Hypothesis

There is no significant relationship between the frequency of use of AI-based adaptive learning tools and the academic performance of science 10 learners.

### Scope and Delimitation of the Study

This study focused on determining the science academic performance of grade 10 learners of Pangasinan School of Arts and Trades through AI-based Adaptive Learning Tools. Specifically, the study examined the AI-based adaptive learning tools that the Grade 10 learners used and how frequent did they use them, and correlated to their science academic performance. The study also investigated the problems encountered by the teachers in teaching using the tools.

The study was limited to Grade 10 learners enrolled at Pangasinan School of Arts and Trades of Lingayen I District in Pangasinan I in the school year 2025-2026. Also, the study focused only on the Science 10 subject. Furthermore, it did not claim the impact of other factors. Finally, a proposed action plan or intervention program was developed based on the findings to help enhance learners' science academic performance using AI-based adaptive learning tools.

### Significance of the Study

The study was significant for the following for several reasons.

**Learners.** Learners are the first to benefit from this study. It helps learners understand how tools that use intelligence can make Science concepts clearer, make their study habits stronger, and make their grades better.

**Teachers.** Teachers also gain from this study. It helps teachers figure out which AI tools are the best to use in the class and plan their lessons and activities with these tools to attend to learners who need extra attention.

**School Administrators.** School Administrators get something out of this study, too. It helps them make decisions about which educational technologies and resources to use so they can improve how well students do overall.

**Educational Researchers.** Educational Researchers are the last to benefit. This study helps them by providing proof of how well AI tools adapt to individual learners really work and how they affect learners' grades. This information can be used for studies on new ways of teaching and learning.

### Definition of Key Terms

**Academic Performance** – Operationally, this refers to the grades of Grade 10 learners in science for third and fourth quarters.

**Action Plan/Intervention Program** – In this study, this refers to the proposed professional development plan for teachers, aiming to enhance the science academic performance of the learners using the AI-based adaptive learning tools.

**AI-Based Adaptive Learning Tools** – Conceptually, these are digital platforms that use artificial intelligence to personalize learning, provide real-time feedback, and adjust lessons according to the learner's performance. In this study, these are the tools used by the grade 10 learners and teachers in the science subject: PhET Interactive Simulations, Molecular Workbench, Perplexity AI, Socratic by Google, Khan Academy, LabXchange, CK-12 (Flexi AI Tutor).

**CK-12 ( Flexi AI Tutor)**- This is powered by AI that provides a high-quality Math and

Science full curriculum for K-1, a digital teacher assistant for every instructor, and a digital tutor for every student.

**Frequency of Use** – The number of times learners’ access and use AI-based adaptive learning tools within a specific time frame.

**Khan Academy** – A widely used educational platform that offers personalized Science and Math lessons, interactive exercises, and progress tracking to help learners master topics at their own pace.

**LabXchange** - This is an online science classroom where students and educators can communicate about a variety of topics through discussion forums, as well as the direct messaging feature.

**Molecular Workbench** - It is a free, open-source modeling and authoring program specifically designed for use in science education. Powered by a set of real-time molecular simulation engines that compute and visualize the motion of particles interacting through force fields, in both 2D and 3D, it provides a simulation platform for teaching and learning science through atomic-scale reasoning. Many important concepts in physics, chemistry and biology that are otherwise too abstract to understand can be visualized with dynamical and interactive simulations.

**Perplexity AI** - It is a free AI-powered answer engine that provides accurate, trusted, and real-time answers to any question.

**PhET Interactive Simulations** - This is a non-profit open educational resource project that creates and hosts explorable explanations.

**Socratic by Google** - This is a discontinued education tech platform that used artificial intelligence to help students with their homework by providing educational resources like videos, definitions, Q&A, links, and more.

## Chapter 2

### RESEARCH METHODOLOGY

This chapter presented the research design, respondents of the study, research instrument, data gathering procedure, statistical treatment of data, and ethical considerations employed in assessing the science academic performance of grade 10 learners of PSAT through AI-based Adaptive Learning tools.

#### Research Design

The study utilized a descriptive–correlational research design. The descriptive method was employed to determine the relationship between the grade 10 learners’ frequency of use of AI adaptive learning tools and their science academic performance. It described the problems encountered by teachers in using the tools in teaching science.

This design was appropriate since the study aimed not only to describe existing conditions but also to determine whether significant relationships exist among the variables without manipulating them.

#### Locale of the Study

The study was conducted at the Pangasinan School of Arts and Trades in Lingayen I for the School Year 2025–2026. The study focused on the Grade 10 Science classes where AI-based

adaptive learning tools were utilized.

### Respondents of the Study

Slovin's formula was used to calculate the minimum sample size needed for the study based on an acceptable margin of error. Based on the computation using a population size of 456 and a margin of error of 0.05, a minimum sample size of 213 grade 10 learners was taken as respondents of the study. The population of each section was divided by the computed sample size to ensure equal representation.

**Table 1**  
**The Grade 10-Learner-Respondents of the Study**

	Section	Sample Size per Section
1	A	23
2	B	24
3	C	23
4	D	20
5	E	22
6	F	19
7	G	20
8	H	21
9	I	21
10	J	20
	<b>Total</b>	<b>213</b>

All 10 science teachers of Pangasinan School of Arts and Trades were also tapped to gather data on the problems encountered in teaching the subject using the AI-based adaptive learning tools.

### Research Instrument

Data were collected through a researcher-made questionnaire designed to assess: the types of AI-based adaptive learning tools used, and the frequency of using the tools.

The questionnaire underwent validation by subject-matter experts to ensure reliability, clarity, and appropriateness for the study's objectives. Learners' Science quarterly grades, from third to fourth, were collected from official school records to measure academic performance.

The questionnaire was designed to measure the frequency of use of the AI-based adaptive learning tools and their relationship to the science academic performance of Grade 10 learners.

The instrument consisted of three parts: Part I – Respondent Profile; Part II – AI Tools Used and the Frequency of Use for the Grade 10 Learner-Respondents; and Part III – Problems Encountered in Using AI-Tools in teaching Science for the Science Teachers, in which the indicators used were adapted from Jacob and Morales (2025).

### Data Gathering Procedure

Permission to conduct the study was secured from the Public Schools District Supervisor and the School Head of Pangasinan School of Arts and Trades of Lingayen I District of Pangasinan I. Upon approval, the researcher personally administered the questionnaires to the

respondents through online and/or face-to-face.

The purpose of the study was clearly explained, and respondents were assured of the confidentiality of their responses. Adequate time was given for the completion of the questionnaires. After retrieval, all accomplished instruments were checked for completeness before data encoding and analysis.

### Statistical Treatment of Data

The data to be gathered will be organized, tabulated, and analyzed using appropriate statistical tools.

To answer problem 1 in determining the AI-based adaptive learning tools commonly used by the learners, the frequency was used.

To answer problem 2 in determining the frequency of use of these tools, the weighted mean was used with Five-point Likert Scale and their descriptive ratings.

Mean Range	Descriptive Interpretation
4.21 – 5.00	Always (Daily)
3.41 – 4.20	Often (Several times a week)
2.61 – 3.40	Sometimes (Once a week)
1.81 – 2.60	Seldom (Once a month)
1.00 – 1.80	Never

To answer problem 3 in determining the science academic performance of grade 10 learners, the following scale was used for interpretation:

Grade	Description Interpretation
90–100	Outstanding
85–89	Very Satisfactory
80–84	Satisfactory
75–79	Fairly Satisfactory
Below 75	Did Not Meet Expectations

To answer problem 4, which determined the significant relationship between the frequency of use of AI-based adaptive learning tools and the science academic performance of grade 10 learners, the Correlation Analysis was used with the formula below.

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Where:

$r$  = Pearson correlation coefficient

$n$  = Total number of observations or data pairs

$\sum x$  and  $\sum y$  = The sum of the  $x$  and  $y$  variables respectively

$\sum xy$  = The sum of the products of each  $x$  and  $y$  pair

$\sum x^2$  and  $\sum y^2$  = The sum of the squared  $x$  and  $y$  variables

$(\sum x)^2$  and  $(\sum y)^2$  = The squared sum of the  $x$  and  $y$  variables

The results were interpreted to identify patterns, associations, and insights that will guide the formulation of a proposed action plan or intervention program.

In determining the problems encountered by the teachers in using AI-tools in teaching

science 10, the weighted mean was used with Five-point Likert Scale and their descriptive ratings.

Mean Range	Interpretation
4.21 – 5.00	Most Common
3.41 – 4.20	Common
2.61 – 3.40	Moderately Common
1.81 – 2.60	Less Common
1.00 – 1.80	Not Common

The results of the study served as the basis for formulating the proposed action plan, which aimed to enhance the academic performance of learners through a school-based workshop for teachers of PSAT.

### Chapter 3

## RESULTS and DISCUSSION

This chapter presents, analyzes, and interprets the data gathered in the study on the academic performance of science 10 learners of Pangasinan School of Arts and Trades through AI-adaptive learning tools as a basis for a proposed action plan to help enhance the performance of the learners and the instruction of the teachers. The data are organized according to the specific problems and are presented in tabular form for clarity and systematic discussion. Furthermore, this chapter provides an in-depth analysis of the results and interprets their implications in relation to the study's conceptual framework and hypothesis.

**Table 2**  
**The AI-based Adaptive Learning Tools Used by the Grade 10 Learners**

	AI-Based Adaptive Learning Tools	Frequency
1	CK-12 (Flexi Ai Tutor)	213
2	Khan Academy	213
3	LabXchange	213
4	Molecular Workbench	213
5	Perflexity AI	213
6	PhET Interactive Simulations	213
7	Socratic by Google	213

Based on the findings, all enumerated AI-based adaptive tools have been used by the grade 10 learners in their science subject. These are the CK-12 (Flexi AI Tutor), Khan Academy, LabXchange, Molecular Workbench, Perflexity AI, PhET Interactive Simulations, and Socratic by Google. Aside from these, the learners do not use any other AI-based adaptive learning tools. This indicated that the grade 10 learners are already inclined to use a variety of AI-based adaptive learning tools. They do not actually use a single tool, but multiple ones to help facilitate their learning activities. This implied that AI-based adaptive learning tools are now essential in the learning of grade 10 learners. These AI tools are already part of their strategies to accomplish their activities to learn, to understand better, and to perform better in their science subject.

**Table 3**  
**AI-based Adaptive Learning Tools Frequently Used by Grade 10 Learners**

	<b>AI-Based Adaptive Learning Tools</b>	<b>Mean</b>	<b>Descriptive Interpretation</b>
1	CK-12 (Flexi Ai Tutor)	3.00	Sometimes
2	Khan Academy	3.00	Sometimes
3	LabXchange	4.00	Often
4	Molecular Workbench	3.00	Sometimes
5	Perflexity AI	3.00	Sometimes
6	PhET Interactive Simulations	4.00	Often
7	Socratic by Google	3.00	Sometimes
	<b>Overall average mean</b>	<b>3.29</b>	<b>Sometimes</b>

Table 3 was formulated that aimed to show which AI-based Adaptive Learning Tools were frequently used by the grade 10 learners in their science subject.

As to frequency of use, LabXchange and PhET Interactive Simulations AI tools were found to have the mean of 4.00 which were described as Often. This indicated that these two tools are used by the learners several times a week in their learning activities in science subject. On the other hand, Ck-12 (Flexi Ai Tutor), Khan Academy, Molecular Workbench, Perflexity AI, and Socratic by Google were found to have the mean of 3.00 which were described as Sometimes. This indicated that these tools are used by the grade 10 learners just once a week in their learning activities in the subject. This implied that LabXchange and PhET Interactive Simulations as AI-based adaptive learning tools are more relevant, helpful and effective in facilitating the learning activities of the grade 10 learners in their science classes. The rest of the tools are used whenever only necessary in a particular activity and lesson in the subject.

**Table 4**  
**Frequency of Using AI-based Adaptive Learning Tools of Grade 10 Learners**

<b>Section</b>	<b>Average Frequency Mean</b>	<b>Descriptive Interpretation</b>
A	3.20	Sometimes
B	3.30	Sometimes
C	3.40	Sometimes
D	3.10	Sometimes
E	3.30	Sometimes
F	3.20	Sometimes
G	3.40	Sometimes
H	3.50	Often
I	3.30	Sometimes
J	3.20	Sometimes
<b>Over-all Frequency Mean</b>	<b>3.29</b>	<b>Sometimes</b>

Table 4 showed the over-all frequency mean of usage of AI-based Adaptive Learning Tools. This table was also formulated to be used in determining the relationship between the frequency of using these tools and their science academic performance, presented in the latter part of this chapter. Clearly, all sections had an average frequency mean, which was interpreted as Sometimes except Section H, which was interpreted as Often. Likewise, the overall frequency mean was 3.29 and described as Sometimes.

This indicated that all sections were given equitable opportunities to use these AI-based Adaptive Learning Tools in science activities. The Science teachers had the proper guidance to ensure ethical considerations in using these AI tools in the classroom.

This implied, however, that the frequency of use of these AI tools was not yet fully integrated in the science class, which may be influenced by the limited access to the internet, insufficient familiarity, and training in using these tools.

**Table 5**  
**Level of Science Academic Performance of Grade 10 Learners**  
**in the Third and Fourth Quarters**

Section	Third Quarter Average	Descriptive Interpretation	Fourth Quarter Average	Descriptive Interpretation
B	94	Outstanding	94	Outstanding
U	92	Outstanding	93	Outstanding
I	91	Outstanding	91	Outstanding
L	84	Satisfactory	87	Very Satisfactory
D	81	Satisfactory	84	Satisfactory
C	81	Satisfactory	85	Very Satisfactory
R	82	Satisfactory	86	Very Satisfactory
A	80	Satisfactory	85	Very Satisfactory
F	83	Satisfactory	85	Very Satisfactory
T	81	Satisfactory	84	Satisfactory
<b>Over-all Average</b>	<b>85</b>	<b>Very Satisfactory</b>	<b>87</b>	<b>Very Satisfactory</b>

Table 3 showed the Science Academic Performance average of each section of the grade 10 learners of PSAT, with the overall average of 85% in the third quarter interpreted as Very Satisfactory and 87% in the fourth quarter interpreted the same as Very Satisfactory.

The Science Academic Performance of the upper 3 sections, including A, B, and C appeared to be outstanding. This indicated and proved that the learners in these sections belonged to the advanced level. The three sections maintained their outstanding performance in the subject, except for section U, with only 1% increase in their class average.

On one side, the performance of other sections, including D, E, F, G, H, I, and J, appeared to be only from Satisfactory to Very Satisfactory. This indicated that though these sections did not meet Outstanding, their performance in the subject significantly improved.

Looking at the overall average, the performance of the grade 10 learners in science in the

third quarter increased by 2% in the fourth quarter. This indicated that the learners generally improved their academic performance. The data implied that the use of AI-based Adaptive Learning Tools in teaching and learning science subjects helped in enhancing the academic performance of the learners.

**Table 6**  
**Relationship between the Frequency of Use of AI-based Adaptive Learning Tools and the Science Academic Performance of Grade 10 Learners**

Variable Pair	df	r	p-value	Interpretation	Decision ( $\alpha = .05$ )
AI-Based Adaptive Learning Tools and Academic Performance of Science 10 Learners (Fourth Quarter)	df 8 (n-2)	r = .982	0000.45	Very Strong Positive Correlation	Significant

Table 6 showed the Pearson Correlation between the frequency of use of AI-based adaptive learning tools and the science academic performance of ten sections of grade 10 learners of Pangasinan School of Arts and Trades.

The result of the computation indicated that the critical value of r at  $df = 8$  ( $\alpha = .05$ ) was approximately .632. The computed value of  $r = .88$  exceeded the critical value. This indicated that there was a very strong positive correlation.

This implied that the use of AI-based Adaptive Learning Tools, with the proper guidance from teachers and with the strong integration of these AI tools in science classes, would greatly help enhance the performance of the learners.

Table 7 showed the problems encountered by the science teachers in using AI tools that ranged from less common to common, with the average weighted mean of 3.25, which was described as Moderately Common.

The common problems encountered by the science teachers were the High cost of implementing and maintaining AI technologies, dependence on technology, lack of training, device unavailability, and Internet connectivity issues.

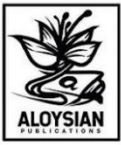
The result indicated that the common problems of the teachers were associated with the technology. This implied that the teachers of Pangasinan School of Arts and Trades were not yet fully provided with the needed devices, access, and training relevant to the use of AI-based Adaptive Learning Tools.

Other problems encountered by the teachers, including the AI-generated content, are irrelevant; Diminished teacher-learner interaction, hinder critical thinking, lack of an adaptive learning approach, and academic dishonesty appeared to be only less and moderately common.

**Table 7**  
**Problems Encountered by Teachers in Using AI-Based Adaptive Learning Tools in Teaching Science**

Problems Encountered	Mean	Descriptive Interpretation
1. High cost of implementing and maintaining AI technologies. The AI-based tools and their maintenance are expensive.	3.50	Common
2. AI-generated content is irrelevant. The AI-based tools provide inaccurate information that does not align with the lesson objectives.	2.40	Less Common
3. Diminished teacher-learner interaction. The AI-based tools lessen the direct interaction between teachers and learners.	2.60	Less Common
4. Hinder critical thinking. The AI-based tools make learners rely on AI-generated answers, which prevents them from thinking critically.	3.00	Moderately Common
5. Dependence on technology. AI-based tools affect the teaching and learning continuity when they become unavailable due to power interruptions or technical malfunctions.	3.60	Common
6. Lack of training. Teachers may have limited technical knowledge in using the AI-based tools, which may lead to ineffective instruction.	3.60	Common
7. Lack of an adaptive learning approach. AI-based tools provide less personalized learning experiences according to their abilities, pace, and needs.	3.30	Moderately Common
8. Device unavailability. The school has limited laptops, tablets, and smartphones for the learners required for AI-based tools.	3.50	Common
9. Internet connectivity issues. Unstable and slow internet access disrupts the flow of teaching and learning.	3.70	Common
10. Academic dishonesty. Learners submit AI-generated outputs as their original work.	3.30	Moderately Common
<b>Average Weighted Mean</b>	<b>3.25</b>	<b>Moderately Common</b>

These results indicated that the teachers did not encounter serious problems when it came to non-technical matters. This implied that the teachers could attend to and address these problems more easily before they became serious. This further implied that the teachers were already trained to manage these existing problems before they get worse.



### **Proposed Action Plan on Enhancing the Skills and Strategies of Science Teachers in Using AI-based Adaptive Learning Tools**

Based on the summary of findings, the proposed action plan would be designed. The training would focus on capacitating science teachers in fully integrating the use of relevant AI-based Adaptive Learning Tools in the classroom, especially those found to be less frequently used, to maximize their instructional competence.

The proposed plan shall consist of the following components:

1. Areas of Concern
2. Targets
3. Activities/Strategies
4. Time Frame
5. Person/Agencies Involved
6. Success Indicators

The plan would be presented in tabular form on the next page.

General Objectives:

Based on the salient findings and conclusions of the study, the increase in the utilization of the AI-based adaptive learning tools in teaching and learning is associated with the higher academic performance of the learners in science. The challenge was that the science teachers were less likely to integrate the AI-based adaptive learning tools into their classes, which may hinder the enhancement of the academic performance of the learners in science. Thus, the action plan would be conceptualized to strengthen the skills and strategies of science teachers of Pangasinan School of Arts in using AI-based Adaptive Learning Tools through School-Based Training, as this study found that they need further enhancement of full integration of AI tools.

Success indicators would be set to ensure the success of the training. Each objective would run for 3 hours over 4 days, scheduled on the strategic dates after class hours. The public school district supervisor, school heads, the master teachers, and the beginning and proficient science teachers should be involved in the training.

<b>Proposed Action Plan on Enhancing the Skills and Strategies of Science Teachers in Using AI-based Adaptive Learning Tools</b>					
<b>Areas of Concern</b>	<b>Targets</b>	<b>Activities/Strategies</b>	<b>Time Frame</b>	<b>Persons Involved</b>	<b>Success Indicators</b>
Limited knowledge and awareness of AI-based adaptive learning tools used in science instruction	Equip 100% of science teachers with foundational knowledge of AI-based adaptive learning tools	<b>Orientation Seminar and Lecture-Discussion</b> on AI-based adaptive learning tools (e.g. Khan Academy, PhET Interactive Simulations, CK-12, LabXchange, Perplexity AI) and their educational applications in science	Day 1 (3 hours)	School Head, ICT Coordinator, Master Teachers, Science Teachers, Public Schools District Supervisor	At least 90% of participants demonstrate increased understanding based on pre-test and post-test results
Limited technical skills in using AI-based adaptive learning tools	Enhance teachers' technical competence in navigating and operating AI-based adaptive learning tools	<b>Hands-on Workshop and Demonstration</b> on account creation, lesson integration, content generation, simulations, assessment creation, and troubleshooting	Day 2 (3 hours)	ICT Coordinator, Master Teachers, Science Teachers	100% of participants successfully perform guided tasks using AI-based tools
Limited integration of AI-based adaptive learning tools in science teaching	Strengthen teachers' instructional strategies in integrating AI tools in science lessons	<b>Lesson Planning Workshop</b> on contextualizing and integrating AI tools into science lesson plans aligned with curriculum standards	Day 3 (3 hours)	School Head, Master Teachers, Department Head, Science Teachers	At least 90% of teachers produce an enhanced lesson plan integrating AI-based adaptive learning tools
Challenges in maximizing learner engagement and academic performance	Improve teachers' classroom implementation strategies	<b>Demonstration Teaching, Peer Coaching, and Learning Action Cell (LAC) Session</b> focusing	Day 4 (3 hours)	Master Teachers, School Head, Science Teachers	At least 90% of participants demonstrate effective integration strategies



using AI tools		on best practices and classroom application of AI-based adaptive learning tools			during demonstration teaching
Problems encountered in accessibility, technical concerns, and classroom implementation	Provide sustainable technical assistance and collaborative support mechanisms	<b>Action Planning and Technical Assistance Planning Workshop</b> to address recurring challenges and establish peer mentoring	End of Training (1 hour integrated session)	School Head, ICT Coordinator, Master Teachers, Science Teachers	Approved school action plan for continuous implementation and monitoring of AI integration

## Chapter 4

**SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

This chapter presents the summary of findings, conclusions, and recommendations.

**Summary of Findings**

The salient findings of this study in determining the academic performance of science 10 learners through AI-based adaptive learning tools are as follows:

1. All AI-based Adaptive Learning Tools provided in this study, including the PhET Interactive Simulations, Molecular Workbench, Perplexity AI, Socratic by Google, Khan Academy, LabXchange, CK-12 (Flexi AI Tutor), have been used by all 456 Grade 10 learner-respondents in PSAT. There have been no other AI tools used by the learners.
2. Concerning the frequency of use, the LabXchange and the PhET Interactive Simulations have been used often or several times a week; while the Molecular Workbench, Perplexity AI, Socratic by Google, Khan Academy, and the CK-12 (Flexi AI Tutor) have been used sometimes or once a week.
3. The academic performance of science 10 learners in the third quarter and in the fourth quarter had the same overall descriptive interpretation of Very Satisfactory.
4. There was a very strong positive correlation between the use of AI-based Adaptive Learning Tools and the academic performance of the science 10 learners.
5. The science teachers have commonly encountered problems in teaching science using the AI tools in terms of the high cost of implementing and maintaining AI technologies; dependence on technology; lack of training; device unavailability; and internet connectivity issues.
6. A School-based Training Workshop on using AI-based Adaptive Learning Tools could be proposed.

**Conclusions**

Based on the salient findings, the following conclusions were drawn:

1. Based on the findings in problem 1, it was concluded that science 10 learners in Pangasinan School of Arts and Trades used AI-based adaptive learning tools, and the learners had not used other AI-based technologies, indicating limited but thorough exposure to AI-supported educational resources.
2. Based on the findings in problem 2, the LabXchange and the PhET Interactive Simulations have been used more frequently by the science 10 learners, while the Molecular Workbench, Perplexity AI, Socratic by Google, Khan Academy, and the CK-12 (Flexi AI Tutor) have been used by them at a moderate frequency.
3. Based on the findings in problem 3, the academic performance of science 10 learners both during the third and fourth quarters appeared to be consistent at a very satisfactory level.
4. Based on the findings in problem 4, this study concluded that the higher frequency of using AI-based adaptive learning tools, the better academic performance in science would be achieved.
5. Based on the findings in problem 5, the science teachers have commonly encountered problems in teaching science using the AI tools in terms of the availability and accessibility of the instruments associated with the technology.



6. A school-based training workshop for teachers, which is necessary to address the problems they encountered in teaching using AI-based Adaptive Learning Tools, would be proposed.

### **Recommendations**

Based on the salient findings and conclusions, the following recommendations are hereby presented:

1. The teachers, with the advice of the school head, shall orient, capacitate, and guide learners in using AI-based Adaptive Learning Tools in their learning activities.
2. The teachers, with the advice of the school head, shall fully integrate the use of relevant AI-based Adaptive Learning Tools in the classroom, especially those found less frequently used and other cheaper versions of AI, such as ChatGPT, Co-Pilot, and Claude, to maximize their teaching capability.
3. The teachers should increase their effectiveness and efficiency of instructional strategies not only to sustain but also to enhance the academic performance of science learners.
4. The teachers should be encouraged to fully integrate AI-based adaptive learning tools in science classes to enhance the academic performance of the learners.
5. The school should attend to the issues regarding the availability and accessibility of AI-related tools by improving the implementation and maintenance of AI technologies; lessening the dependence on technology; conducting training; providing needed devices and enhanced internet connectivity.
6. Lastly, the proposed school-based training should be implemented to capacitate science teachers with the necessary skills and strategies in using AI-based adaptive learning tools in teaching.

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