



COMPARATIVE STUDY OF THE EFFECTIVENESS OF TEACHING WITH POWERPOINT PRESENTATIONS AND CONVENTIONAL METHODS TO IMPROVE THE ACADEMIC PERFORMANCE OF PHYSICS STUDENTS ON THE TOPIC OF RESISTANCE

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ABSTRACT

The aim of this research is to analyse and describe the effectiveness of teaching with PowerPoint and conventional teaching methods in improving students' academic performance. Researchers use quantitative instruments confirmed through validity (0.435 - 0.870) and reliability (Cronbach's alpha 0.557 - 0.753). Results shown on the normality test of academic performance classes, A and B consistent. Class B shows an abnormal distribution because the significance value is (Wilk = 0.0005 < 0.05 and 0.000 < 0.05). This shows that the reliability values for XA and YA are 0.716 and 0.557, respectively. Variable XB = 0.753 and YB = 0.619. It means the reliability value is greater than the tabulated r value = 0.288. It proves that the values can be extracted. The homogeneity test concluded that the academic performance of classes A and B is homogeneous, as the p-value of 0.513 is greater than 0.05. The hypothesis test of classes A and B on academic performance is different. If Sig 0.000 < 0.05 when comparing both shows, the average value for class A is higher than B (16.69 > 14.28). Thus, the use of PPT is better for students' academic performance.

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INTRODUCTION

According to the Constitution of the Democratic Republic of Timor-Leste, Article 59 on Education and Culture, paragraphs 1 and 2, the State recognises and guarantees citizens' right to education and culture and has the responsibility to create a public system of universal, compulsory, and, where possible, free basic education, as required by law. Everyone has the right to equal opportunity in education and vocational training. (C-RDTL, 2007). Based on the Basic Education Decree-Law No. 14/2008 of October 29, issued by the Ministry of Education of Timor-Leste, the main objective is to establish guidelines for the development of the education system. Article 1, paragraph 4, establishes that the State guarantees and ensures the possibility of qualified and adequate teachers, infrastructure, and the financial means necessary to guarantee quality education. Thus, the State works to achieve an education system that meets local, regional, and international quality standards. All of this is to enhance Timor-Leste's human resources across various aspects of life and to align with global changes and advances in scientific and technological knowledge.

Education is one of the most important things in a person's life, because education can change people's thinking and behaviour for the better. Education can produce graduates or talents of quality, and vice versa. The availability of quality resources can benefit the nation and state (Da Costa & Freitas, 2025).

The development of information and communication technology has had a significant impact on education, particularly on classroom learning. Teachers, as facilitators, need to use a variety of learning media to make the teaching and learning process more engaging, interactive, and effective. One frequently used medium is Microsoft PowerPoint, which allows material to be presented visually and dynamically (Lestari et al., 2024).

Some teachers do not yet understand how important it is to use appropriate learning media so that learning does not feel monotonous and boring to students. Learning media can provide concrete experiences and serve as intermediaries that support student learning (Wulandari et al., 2023). PowerPoint is a presentation program developed by Microsoft. Microsoft PowerPoint is software that can help organise materials during presentations easily and effectively. Microsoft PowerPoint is also very easy to use by all groups, making PowerPoint widely used for presentations,

teaching, and creating animations (Da Costa & Freitas, 2025).

Learning with conventional methods typically involves lectures with explanations, assignments, and exercises. Over time, conventional media continues to evolve through innovation to keep pace with technological advances and remain relevant in the modern era (Yuniarti et al., 2023). Digital learning methods offer a more innovative and flexible approach. Students can access information quickly and easily through digital technology, such as computers or other online learning applications. By learning through videos, quizzes, and discussion forums, student learning becomes more interactive (Dari et al., 2025).

Academic achievement is the result of activities carried out by an individual or a group. Academic achievement is what one has been able to accomplish through one's work — results obtained with joy through hard work. Academic achievement in school, which is cognitive in nature, is also commonly measured by teachers (da Costa et al., 2019; Ilidio et al., 2023).

The use of learning media in the teaching and learning process can foster new interest and desire, generate motivation, and even exert psychological influence on learning (Wulandari et al., 2023). Through learning media, educators and students gain benefits, namely the facilitation of message delivery and reception, which schools can establish and achieve (Olo Tomé et al., 2022). According to Nasa'i & Sari (2023), learning media serve as instruments that create meaningful learning for students. The media focus of this research is PowerPoint.

PowerPoint is a presentation tool that is often used to deliver information arranged and presented in slide form. Through PowerPoint, audiences can more easily understand material explanations thanks to the visualisations on the slides. By using interactive elements such as hyperlinks, videos, or animations, presentations can be transformed into more engaging and dynamic experiences (Costa et al., 2019).

The media creation model using PowerPoint involves hyperlinks, producing an interactive presentation with a menu of learning materials, including text, images, video, and animation. Nurwahidin et al. (2024) explain the advantages and disadvantages of PowerPoint media as a teaching aid, including: The advantages of using PowerPoint media are: (1) presentations will look more interesting due to the use of color combinations, fonts, animations, as well as images and photos; (2) it can

better stimulate students to seek information about the teaching material; (3) messages or information in visual form are well presented so that educators do not need to explain further; (4) it explains lesson material in detail since the points contained in the learning content are already shown on the PowerPoint slides; (5) it uses slides with no limit on the number of pages to be used according to the material to be delivered, and can be reused; and (6) results can be stored in the form of CDs, diskettes, and flash drives.

On the other hand, the disadvantages of using PPT are: (1) when using PowerPoint media, hardware is needed to display the teaching material to be delivered, such as an LCD and projector; (2) its procurement requires high costs and not all schools can provide it; (3) it requires planned preparation before making a slide show, especially in the proper use of animation presentation techniques, which clearly takes a long time; (4) not everyone can create and operate it; and (5) it is vulnerable to damage on the hard disk or malware attacks. One alternative is the conventional learning model.

Conventional is a method of delivering information orally to a large audience. Activities often carried out in the classroom during conventional learning include students listening to the teacher's presentation while the teacher gives examples and solves problems on the board (Unique, 2021). Some conventional learning models include: the lecture method, the discussion method, the training method, the question and answer method, the experiment method, the demonstration method, the recitation method, the group work method, the socio-drama method, the role play method, the team system, and the field trips (Vaz et al., 2022).

Conventional learning is characterised primarily by a teacher-centred approach, in which the teacher is the primary source of information and students take a passive role. The classroom learning process is generally one-way, relying on lectures with little interaction or discussion. The use of media and technology is limited, and assessments focus more on final results, such as written tests. This model discourages creativity, collaboration, and critical thinking skills in students; while still being widely used, conventional learning needs to be combined with modern approaches to be more effective and engaging.

METHOD

Methodology is the body of methods and rules followed in a science or discipline. While the method itself is a regular, systematic plan or way of doing something (Saputra et al., 2018). Quantitative research is a systematic, planned, and organised research method carried out from start to finish. In other words, quantitative research is a type of research that frequently uses numbers to collect data, interpret, and present results (Brito & Da Costa, 2023). This research design is more objective, using controlled and experimental approaches, numerical data, statistical analysis, and a structured framework (Saputra et al., 2023) to yield experimental results.

Experimental research is a type of research that aims to demonstrate the effect of a treatment on its consequences. In the field of education, experimental research is a research activity that aims to determine the effect of an educational action on student behaviour or to test a hypothesis about whether a given treatment has an effect compared to other actions. Actions in experimental research are called treatments, meaning all actions or variations whose effects will be identified (Arib et al., 2024).

The research period during which the researcher conducted the research began on September 9, 2025, and concluded on September 11, 2025. Population refers to the total group that becomes the object of the research. Population is a general term referring to objects or subjects that possess certain qualities and characteristics, which serve as the object of research and from which conclusions are drawn (Nurfadillah, 2024). The population in this research consists of 175 students from class 120 of CTA-D, Private General Secondary School Cristal, year 2025.

According to Wahyuningsih (2022), a sample is a subset of the population that is expected to represent the population in a study. A sample is a part of the population and reflects its characteristics. In research, samples are used to represent the entire population, so that results from the sample can be generalised to the larger population. Therefore, researchers must take samples that are truly representative. To determine the sample, the researcher calculated based on the formula (Riduwan, 2023) as follows:

$$\begin{aligned} & ; = ; ; = ; = \\ & = 63,6 \text{ ou } 64 \end{aligned}$$

The sample was selected using cluster sampling, in which the sample for this research was taken from Class A and Class B within the population of Class 120 CTA and 120 CTB, with each class having 64 students, giving a total sample of 64 people from the determined class, which serves as the sample for this research.

The method the researcher carried out was direct observation in the field, or at the research location, for phenomena that occurred to serve as the unit for a comparative study of the effectiveness of PowerPoint media learning vs conventional methods in improving student academic achievement in Physics, with the topic of Resistance at Private General Secondary School Cristal Balide.

Observation is the basis of all science. Scientists can only work based on data, namely facts about the real world obtained through observation. The Observation Technique in this study was carried out by directly observing and systematically recording phenomena in the field, in which researchers come directly to the research object to observe transaction activities at the research location (Khoiriah, 2022).

This technique was used by the researcher to carry out the Physics learning process on the topic of Resistance, using PowerPoint media learning strategies vs. conventional methods, for students in 2025, with the aim of assessing students' capacity after participating in the learning activities. A questionnaire is a method for collecting data that uses prepared questions or statements. The purpose of distributing this questionnaire is to obtain clear information about a problem, so that people responding do not feel afraid to give responses that do not match what the researcher wants, including documentation.

According to Collins et al. (2021), documentation is a recording activity that produces documents that can be used as evidence for a statement. Based on various opinions, it can be understood that documentation is the process of recording an object of knowledge in another form repeatedly; it produces a document that is useful as proper evidence.

Research Instrument

Validity Test

According to Hermawan (2020), validity is the extent to which a measuring instrument measures what it is intended to measure rather than something else, ensuring that the measurement results are valid. The validity test assesses the accuracy of a test that respondents have completed. To determine whether the test is valid, examine whether the test experiment correctly reveals what the questionnaire measures.

Where:

Means :

= coefficient correlation

= total pontuation item

= total pontuation

n = númber of respondent

The Pearson product-moment correlation, symbolised by r , will have a value no greater than $(-1 \leq r \leq +1)$. When: (a) $r = +1$, it signifies the strongest positive correlation; (b) $r = -1$, it signifies a negative correlation; (c) $r = 0$, there is no correlation. When $0 < r < 1$, there is a positive correlation between variables X and Y. When $-1 < r < 0$, there is a negative correlation between variables X and Y.

The validity of each item is determined by the calculated r value, which is then compared to the r table value for the product-moment correlation. When the calculated r is greater than the r value in the table, and the comparison is at the 5% significance level, the instrument in question is considered valid. The method used to test the reliability of the questionnaire in this study is the Cronbach's Alpha coefficient formula, as follows:

- a. If the Alpha coefficient result is $> 60\%$ or 0.60 , the questionnaire is reliable.
- b. If the Alpha coefficient result is $< 60\%$ or 0.60 , the questionnaire is not reliable.

The data analysis prerequisite test can be divided into several types: normality tests, linearity tests, autocorrelation tests, multicollinearity tests, and heteroscedasticity tests. The definition and prerequisite analysis tests used in this research are as follows:

RESULT AND DISCUSSIONS

Respondent Classification Based on Age

Graph 1: Respondent Classification Based on Age

Based on the graph above, it shows that the research conducted at Private General Secondary School Cristal had a total of 64 respondents, composed of Class A respondents with ages: 16 years old — 3 students, 17 years old — 14 students, 18 years old — 13 students, and 19 years old — 2 students; and Class B respondents with ages: 16 years old — 1 student, 17 years old — 13 students, 18 years old — 11 students, and 19 years old — 7 students. It can therefore be concluded that the majority of students are 17 years old, which is more than any other age group.

Time Spent Studying Physics at Home Each Week

Graph 2: Study Time Per Week

Based on the graph above, it shows that the time respondents/students spend studying Physics material each week is mostly less than 1 hour, for both Class A and Class B. According to Azizah (2025), the Validity Test determines whether a research measuring instrument is valid. In this case, validity can be interpreted as the ability of a measuring instrument to measure what it is supposed to measure, or to determine the accuracy of a measuring instrument. The responses from the experimental test and the test numbers were then processed and analysed using SPSS 21.0 for correlation and other analyses. To identify the validity of each question item, we look at the significance of the correlation between each item and the total score (last column), with the following criteria:

- a. If the significance value < 0.05 (5%), the item is valid.
- b. If the significance value > 0.05 (5%), the item is invalid.

The output shows that, for PPT media vs the conventional method, the significance values (0.000; 0.000; 0.000; 0.000; 0.000) are < 0.05 (5%), indicating that all items are valid. Another way to identify the validity of items is by comparing the r value (from the correlation of each item with the total score) with the r -table, with the following criteria:

- a. If the calculated r value $> r$ -table, the item is valid.
- b. If the calculated r value $< r$ -table, the item is not valid. The r -table for $\alpha = 0.05$ (5%)

with degrees of freedom ($df = n - 2$) means $df = 64 - 2 = 62$.

Based on the validity test results for Variable XA, which show that all indicators of the PowerPoint media variable (XA) are valid, because the calculated r value is greater than the r -table and has a significance value of 0.000. Therefore, this research instrument can be

used to measure the variable for continued research. A summary of the table values above is as follows:

XA.1	.641**	0.288	0.000	Valid
XA.2	.795**	0.288	0.000	Valid
XA.3	.814**	0.288	0.000	Valid
XA.4	.591**	0.288	0.000	Valid
XA.5	.859**	0.288	0.000	Valid

Table 1. Variable XA (PPT Media Usage)

Based on the validity test results for the variable shown in the table above, all indicators of Academic Achievement (YA) are valid, as the calculated r value is greater than the r-table and has a significance value of 0.000. Therefore, this research instrument can be used to measure the variable used to proceed further. If the validity test results show a significance value of 0.000 for the Learning Achievement (YA) indicators, then the instrument is valid and can be used to measure the variable because a p-value < 0.05 (standard significance level) indicates a significant correlation between items and the total score, meaning the items measure the same thing as the total variable. The summary table is as follows:

YA.1	.591**	0.288	0.000	Valid
YA.2	.641**	0.288	0.000	Valid
YA.3	.679**	0.288	0.000	Valid
YA.4	.435**	0.288	0.013	Valid
YA.5	.694**	0.288	0.000	Valid

Table 2. Validity of Variable YA (Academic Achievement)

Based on the validity test results for Variable XB shown in the table above, all indicators of Conventional Method Usage (XB) are valid, as the calculated r value is greater than the r-table and has a significance value of 0.000. Therefore, this research instrument can be used to measure the variable used to proceed further. The researcher's summary table is as follows:

XB.1	.704**	0.288	0.000	Valid
XB.2	.732**	0.288	0.000	Valid
XB.3	.679**	0.288	0.000	Valid
XB.4	.870**	0.288	0.000	Valid
XB.5	.671**	0.288	0.000	Valid

Table 3. Validity of Variable XB (Conventional Method Usage)

The validity test assesses the consistency between the data reported by researchers and the data obtained directly from research subjects. The validity test is used to measure the validity of a questionnaire. A questionnaire is considered valid if its statements accurately reflect what it is intended to measure. Based on the validity test table for Variable YB, the results show that all indicators of **Academic Achievement (YB)** are valid. This is because the item-total correlation coefficient (r-calculated) is greater than the critical value (r-table), and the statistical significance = $0.000 < 0.05$. Based on these results, this research instrument demonstrates good validity and can therefore be used to measure and assess the **Academic Achievement (YB)** variable in the ongoing research. The summary results of the Academic Achievement table above are as follows:

XB.1	.704**	0.288	0.000	Valid
XB.2	.732**	0.288	0.000	Valid
XB.3	.679**	0.288	0.000	Valid
XB.4	.870**	0.288	0.000	Valid
XB.5	.671**	0.288	0.000	Valid

Table 4. Validity of Variable YB (Academic Achievement)

Reliability Test

The confirmability test is an objectivity test in qualitative research that ensures research results can be verified and linked directly to the research process. This is done by demonstrating that research findings are not influenced by the researcher's bias but genuinely reflect the data collected using agreed-upon methods.

Based on the reliability test results, we can see them in the table below:

0.716	0.725	5
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Table 5. Reliability Test for Variable XA (PPT Media Usage)

Based on Table 4.5, the Cronbach's Alpha value is 0.716. This value is greater than 0.60 ($0.719 > 0.60$), indicating that all items for the PPT media usage variable are reliable.

0.557	0.583	5
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Table 6. Reliability Test for Variable YA (Academic Achievement)

0.753	0.786	5
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Table 7. Reliability Test for Variable XB (Conventional Method)

0.619	0.619	5
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Table 8. Reliability Test for Variable YB (Academic Achievement)

From the SPSS version 21.0 analysis results table, the reliability of Variable XA, Variable YA, Variable XB, and Variable YB is summarised in the following table:

Variable XA	0.716	0.288	5	Reliable
Variable YA	0.557	0.288	5	Reliable
Variable XB	0.753	0.288	5	Reliable
Variable YB	0.619	0.288	5	Reliable

Table 9. Summary of Reliability Tests for Variables XA, YA, XB, and YB

Based on the calculations in the table above, the reliability values are: Variable XA = 0.716, Variable YA = 0.557, Variable XB = 0.753, and Variable YB = 0.619. All reliability values exceed the r-table value of 0.288, so it can be concluded that all four variables fall into the reliable category and can proceed to further analysis.

Normality Test

The normality test is conducted to evaluate the distribution of a data group or variable and determine whether it is normal. The normality test is a procedure used to

determine whether data are normally distributed. The results of the normality test can be seen in the table below:

Table 10. Normality Test (Y Total A and B)

This section will test whether a data distribution is normal. The decision-making guidelines are:

- a. If the Shapiro-Wilk significance value is < 0.05 , the data distribution is not normal.
- b. If the Shapiro-Wilk significance value or probability value > 0.05 , the data distribution is normal.

Based on Table 10, the Shapiro-Wilk significance values (probabilities) for the academic achievement data are: Class A = 0.005 and Class B = 0.000. Therefore, it can be concluded that the academic achievement data for both Class A and Class B do not have a normal distribution, because the Shapiro-Wilk significance or probability values are less than 0.05 ($0.005 < 0.05$ and $0.000 < 0.05$).

Homogeneity Test

Y_Total	Based on Mean	0.433	1	62	0.513
	Based on Median	0.196	1	62	0.659
	Based on Median and with adjusted df	0.196	1	55.115	0.659
	Based on trimmed mean	0.400	1	62	0.529

Table 11. Homogeneity Test

The decision-making criteria for the homogeneity test are as follows:

- a. If the significance value or probability value based on the mean is less than 0.05, the data is not homogeneous.
- b. If the significance value or probability value based on the mean is greater than 0.05, the data is homogeneous.

Table 4.11 shows that the significance value (probability value) based on the mean is 0.513. Therefore, it can be concluded that the academic achievement data for both Class A and Class B are homogeneous, because the significance value or probability value based on the mean is greater than 0.05 ($0.513 > 0.05$).

Hypothesis Test

After conducting the normality and homogeneity tests on student academic achievement data, the results showed that the data are not normally distributed but are homogeneous. Because the data do not meet the criteria for parametric testing, the hypothesis test will use a nonparametric test, the Mann-Whitney U test, since the samples are unrelated. The criteria for the hypothesis test are: If the probability value is asymptotic. Sig (2-tailed) value is less than 0.05, which means there is a difference between the academic achievement of Class A and Class B.

a. If the probability value or asymptotic Sig (2-tailed) value > 0.05 , which means there is no difference between the academic achievement of Class A and Class B.

Table 4.6 shows the probability value or the asymptotic value. Sig (2-tailed) value is 0.000. Therefore, it can be concluded that there is a difference in academic achievement between Class A and Class B, or the academic achievement of Class A is not the same as Class B, because the probability value is asymptotic. Sig (2-tailed) value is less than 0.05 ($0.000 < 0.05$). Next, we will further describe which is better: PPT media or the conventional method. To determine this, we will use the results of descriptive analysis as shown in the following table:

Based on the SPSS version 21.0 for Windows output in Table 11, the mean academic achievement for Class A is 16.69, while it is 14.28 for Class B. A comparison of these two values shows that the mean academic achievement value of Class A is greater than that of Class B ($16.69 > 14.28$). Therefore, it can be concluded that PPT media is preferable because it can positively influence student academic achievement.

Discussion

Based on the analysis results above, it shows that the use of the PowerPoint (PPT) media method and the conventional method in the learning process resulted in different academic achievement outcomes among students. This is shown through the asymptotic. Sig (2-tailed) value, which is less than 0.05 ($0.000 < 0.05$), meaning there is a difference in academic achievement between Class A students taught using PPT media and Class B students taught using the conventional method. This indicates that student academic achievement also depends on the methods the teacher uses in the learning process.

According to Rina Widyawati (2020), this study aimed to compare the learning achievement of Class A students who used PowerPoint media with Class B students who

used the conventional method. The data analysis showed that the average score for Class A was higher than that for Class B. The test obtained a significance value (p) of $0.000 < 0.05$, indicating a significant difference between the two groups. Therefore, it can be concluded that learning with PowerPoint media in Class A was more effective at improving student achievement than conventional methods.

These results also show that the PPT media usage method is more effective than the conventional method, as evidenced by the mean academic achievement of Class A students exceeding that of Class B students ($16.69 > 14.28$). This shows that integrating learning media into the learning process benefits students.

CONCLUSIONS

Based on the results of the study comparing PowerPoint (PPT) and conventional methods, it can be concluded that:

1. The use of PowerPoint, with a Cronbach's Alpha of 0.716 ($0.716 > 0.60$), has been shown to be more effective than conventional methods in improving student achievement.
2. The average learning outcomes of Class A students taught using PPT were higher than those of Class B students taught using the conventional method. A comparison of these two values shows that the mean academic achievement value of Class A is greater than that of Class B ($16.69 > 14.28$). These results also show that the PPT media usage method is more effective than the conventional method.
3. Interactive media such as PowerPoint can enhance student comprehension, motivation, and active participation in the learning process. The data analysis showed that the average score for Class A was higher than that for Class B. The test obtained a significance value (p) of $0.000 < 0.05$

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