

The Influence of Infographic Learning Media on Analytical Thinking Skills and Student Learning Outcomes

Ghinaa Ghaisani ^{a,1}, Diana Hernawati ^{a,2}, Egi Nuryadin ^{a,3,*}

^a Department of Biology Education, Faculty of Teacher Training and Education, Universitas Siliwangi, Tasikmalaya, Indonesia

¹ ghinaagghaisani@gmail.com; ² hernawatibiologi@unsil.ac.id; ³ eginuryadin@unsil.ac.id

* Corresponding author: eginuryadin@unsil.ac.id

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ABSTRACT

The ability to think analytically is essential for students in the 21st century because it helps solve problems and make decisions. When students' analytical thinking skills are low, it also affects their learning outcomes. One effort to improve this is through infographics. This study aims to determine the effect of infographic learning media on analytical thinking skills and student learning outcomes on the Genetic Substance material in class XII MIPA Madrasah Aliyah Negeri (MAN) 3 Tasikmalaya City. The research method used was a quasi-experimental design with a nonequivalent control group. The population in this study consisted of all XII MIPA MAN 3 Tasikmalaya City School Year 2023/2024, totaling 54 students. The sampling technique used was purposive sampling; class XII MIPA 2 was the experimental class, and class XII MIPA 1 was the control class. The instruments used were a multiple-choice test to measure learning outcomes (23 items) and a description test to measure analytical thinking skills (7 items). The data analysis technique used was ANCOVA. Based on the results of data analysis and hypothesis testing, the significance value for analytical thinking ability and learning outcomes is 0.000 ($p \leq 0.05$). Therefore, it can be concluded that the infographic learning media has an effect on analytical thinking skills and student learning outcomes in the Genetic Substance material in class XII MIPA MAN 3 Tasikmalaya City.

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Keywords: Infographic learning media, Analytical thinking skills, Learning outcomes, Genetic substance

Introduction

Education is the most important foundation of a country, including in Indonesia. Education is a vehicle and instrument for freeing people from backwardness, ignorance, and poverty, so a good system and quality are needed. Apart from that, education must also explore and develop a person's abilities and skills thoroughly so that they are useful in the world and the future ([Sari et al., 2018](#)). However, based on the results of the PISA (Program for International Student Assessment) study in 2018, Indonesia is ranked 72nd out of 77 countries in the reading category, with an average score of 371. In the mathematics ability category, Indonesia has an average score of 379. It is ranked 72nd out of 78 countries and, in the science skills category, 70th, with an average score of 396 ([Schleicher, 2019](#)). This shows the Indonesian students' lack of ability in calculating, reading, and science, which also affects their learning outcomes.

Learning outcomes play an important role in the teaching and learning process, namely by helping teachers monitor student progress and fulfill learning objectives ([Mahariyanti & Hadi, 2020](#)). The success rate of this learning objective can be seen from the increase in learning outcomes, which is directly proportional to the level of understanding and mastery of the material. In addition, learning outcomes are closely related to students' activities and abilities, including the ability to think analytically. Students must be able to think analytically because this ability is not only for mastering the material studied, but also for identifying problems and finding solutions to problems that arise, including in everyday life ([Setiawaty et al., 2019](#)). However, in practice, students' analytical thinking skills remain low, as evidenced by Indonesia's five-year run at the bottom of the country rankings in the Trends in International Mathematics and Science Study (TIMSS), which measured the content domain used to determine subjects. The cognitive domain used to determine students' abilities related to knowing, applying, reasoning, analyzing, evaluating, and creating ([Prawita et al., 2019](#)).

In line with the research results above, researchers conducted observations at Madrasah Aliyah Negeri (MAN) 3 Tasikmalaya City on June 10, 2023, to examine students' learning outcomes and analytical thinking skills. The results obtained show that the analytical thinking ability and learning outcomes of students are still low, which can be seen when students in the classroom, such as students who are unable to ask questions or provide arguments, are unable to analyze, solve, or find solutions to problems given, and cannot provide a conclusion on a problem. This indicates that analytical thinking skills remain insufficient, thereby affecting students' learning outcomes. Apart from that, it is also known that the learning media used are still less varied and creative. This lack of varied, creative learning media causes students to become sleepy, passive, pay less attention to the teacher, and even chat with their friends while the teacher explains the material. The use of learning media can be encouraged to help overcome the problems students experience. Apart from that, with the rapid development of technology, the use of learning media can be aligned with technological developments, producing effective learning media that are up to date. Infographics are considered to be one of the learning media resulting from collaboration with technological developments.

Infographics are an engaging learning medium and a way to communicate learning materials visually. Learning materials in infographics include organized images and contextual ideas that can help students understand concepts and principles more easily and can increase students' interest in learning ([Apriyanti et al., 2020](#)). In addition, infographics can more easily support learning at all levels of the educational process, fostering the ability to understand non-verbal text, generalize data, build logical frameworks, and stimulate students' cognitive interest ([Kalimbetova & Ilesbay, 2020](#)). The aim of using infographics is to improve student learning outcomes and analytical thinking skills, which should be applicable at the high school level.

Methods

This research uses a quantitative approach with a quasi-experimental and a nonequivalent control group design. The research begins in August - September 2023 at MAN 3 Tasikmalaya City. The population in this study comprised all class XII MIPA students at MAN 3 Tasikmalaya City for the 2023/2024 academic year, totaling 54 students. The selected samples are determined through the purposive sampling technique. This purposive sampling technique is based on several criteria and suggestions from biology subject teachers, including selecting classes with the same learning activities, the same average daily test scores, the same attendance rate, the same problem-solving ability, and the same ability to answer the same questions. Based on these considerations and suggestions, class XII MIPA 2 was chosen as the experimental class and class XII MIPA 1 as the control class. The material used is a genetic substance. An overview of research using a nonequivalent control group design, according to [Sugiyono \(2019\)](#), is presented in Table 1.

Table 1. Design nonequivalent control group

Group	Pre-test	Treatment	Post-test
Experimental	O ₁	X ₁	O ₂
Control	O ₃	X ₂	O ₄

Information:

O1: Pre-test experimental group

O2: Post-test experimental group

O3: Pre-test control group

O4: Post-test control group

X1: Treatment with the use of infographic learning media

X2: Treatment with the use of *PowerPoint*

The indicators used in this research to measure analytical thinking skills are presented in a description test with 7 questions that address the following indicators: differentiating, organizing, and connecting. Meanwhile, the instrument used to measure learning outcomes is a 23-item multiple choice test which refers to indicators of cognitive process dimensions at the levels of remembering (C1), understanding (C2), application (C3), analysis (C4), and evaluation (C5), as well as knowledge (K1), conceptual (K2), and procedural (K3) dimensions.

The data collected in this research are the results of the pre-test and Post-test. To determine the increase in analytical thinking skills and learning outcomes by measuring Pre-test and Post-test using N-gain. The data analysis technique uses parametric statistical analysis, including hypothesis testing and Analysis of Covariance (ANCOVA), with IBM SPSS version 23 for Windows. This hypothesis test can be carried out after conducting prerequisite tests, including normality and homogeneity tests. N-gain results are categorized according to [Hake \(1998\)](#), shown in Table 2.

Table 2. N-Gain index category

N-gain score (g)	Category
$0.70 \leq n \leq 1.00$	High
$0.30 \leq n \leq 0.70$	Medium
$0.00 \leq n \leq 0.30$	Low

Results and Discussion

The data used in the study were normally distributed and also had homogeneous variances. Furthermore, hypothesis testing was conducted using Analysis of Covariance (ANCOVA) to determine the effect of infographic learning media on analytical thinking skills and student learning outcomes. The results of the ANCOVA test are shown in Table 3.

Table 3. Results of ANCOVA test

Tests of Between-Subjects Effects						
Dependent Variable: Learning Outcomes						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	279.389 ^a	2	139.694	15.152	.000	.479
Intercept	142.723	1	142.723	15.480	.000	.319
KBA	39.139	1	39.139	4.245	.047	.114
Kelas	154.613	1	154.613	16.770	.000	.337
Error	304.250	33	9.220			
Total	6,385.000	36				
Corrected Total	583.639	35				

a. R Squared = .479 (Adjusted R Squared = .447)

Based on the table above, it is shown that the Corrected Model has a significance value of 0.000 and is less than < 0.05 . The Corrected Model is interpreted as the effect of all independent variables on the dependent variable, simultaneously. It can be concluded that the Corrected Model value, as an interpretation of the significance of the independent variables, is smaller than 0.05, indicating that the use of infographic learning media has a significant effect on students' analytical thinking skills and learning outcomes.

This research found that the infographic learning media influenced analytical thinking skills and students' learning outcomes in the genetic substance material in class XII MIPA MAN 3 Tasikmalaya City for the 2023/2024 academic year. During the learning process, students in the experimental class did not experience difficulties finding learning resources because most of the sources they needed could be accessed offline on smartphones by downloading infographic applications as learning media, and the treatment provided. This is considered suitable for students in the Generation Z category, who really like convenience and instant things. This is because Generation Z has a way of learning that prefers visual formats, relies on technology, easily understands information that is accurate, real, factual, and useful, and actively learns independently (Luhulima et al., 2016). Infographics can be one of the answers to the desired convenience, because with its advantages that can contain interesting images and sentences, it makes it easier for teachers to convey learning messages with the aim that students are more imaginative and can foster the habit of learning independently (Putra, 2021).

Furthermore, after the research was conducted, data on analytical thinking skills were collected using a description test question comprising 7 questions. The comparison of the average scores for pre-test, post-test, and N-gain in analytical thinking skills for experimental and control class students is shown in Figure 1.

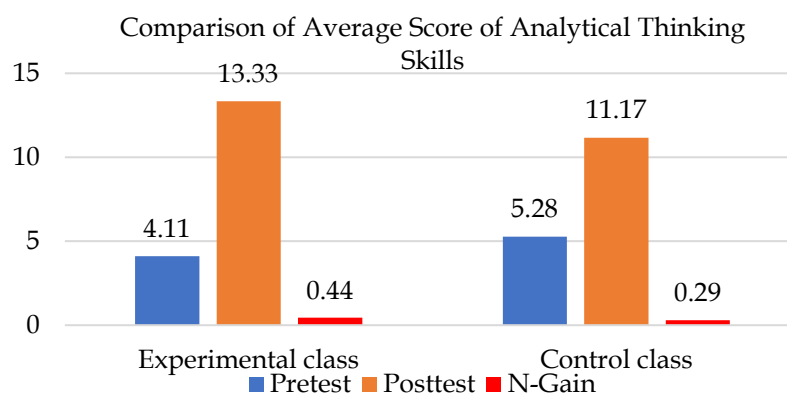


Figure 1. Average score of analytical thinking skills

Figure 1 shows a significant difference in the average score for analytical thinking skills between the two research classes. The average N-gain score of 0.44 for the experimental class

is in the medium category. The control class obtained an N-gain score of 0.29 in the low category. Based on the N-gain scores, the experimental class's N-gain score is higher than the control class, indicating that the infographic learning media is more effective at improving students' analytical thinking skills. This is in line with what [Pratama et al. \(2022\)](#) revealed: infographics are effective in training analytical thinking skills, as evidenced by the average percentage of indicators at 81%.

The average scores for analytical thinking skills of experimental and control class students, based on indicators from [Anderson & Krathwohl \(2010\)](#), are shown in Figure 2.

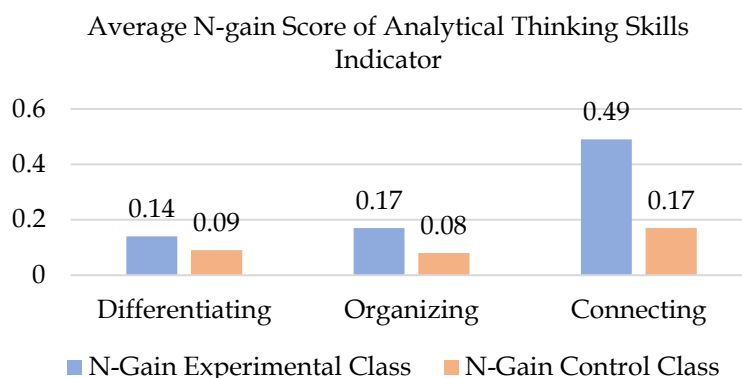


Figure 2. Average N-Gain score of analytical thinking skills per-indicator

From Figure 2, it can be seen that the experimental class has a greater N-gain value than the control class. The indicator with the highest N-gain score is the connecting indicator, with an experimental class N-gain score of 0.49, which is in the medium category. While the control class N-gain score is 0.17 which is included in the low category. When viewed through the questions presented, students tend to find it easier to answer connecting-indicator questions than distinguishing or organizing questions. This is because the connecting question already provides answers for students to choose from. Moreover, in other connecting questions, there is already a brief review of material that is directly or indirectly related to the question, thereby minimizing the answer space or, in other words, simplifying the answer choices in students' minds. In addition, infographics allow students to remember information more easily because complex information is simplified and linked or connected by design into a single unit ([Pramesti & Nabillah, 2021](#)).

In the differentiating indicator, the N-gain value of the experimental class received a score of 0.14 including the low category, while the control class N-gain score was 0.09 and included the low category. For the organizing indicator, the experimental class N-gain score was 0.17 and included the low category, while the control class N-gain score was 0.08 and also included the low category. Although both classes on the indicators of distinguishing and organizing have values that are included in the low category, there is a difference in value that is not too significant, which proves that infographics are still one of the learning media that can help students to understand the material, even though the material is quite difficult to understand. When students encounter questions in the High Order Thinking Skills (HOTS) category, such as those in the distinguishing and organizing indicators, what is needed to answer them is the ability to think, connecting to difficult reasoning that relies on strong memory ([Fazriani et al., 2019](#)). When viewed across all indicators, the differentiating and organizing indicators have low N-gain values, which may be due to several factors. These include not being accustomed to solving HOTS questions, a lack of understanding of the material, not understanding the sentences in the questions, and not being careful in reading and understanding the questions ([Nuraini & Julianto, 2022](#)).

Infographic learning media used in experimental classes are quite effective in simplifying material concepts through visualization and in attracting students' attention and concentration, thereby having the potential to develop students' analytical thinking skills,

which are closely related to problem-solving, critical, and scientific thinking. This is in line with [Al-Mohammadi's \(2017\)](#) research, which concluded that infographics are effective and play an important role in simplifying information so that learners can read it easily and quickly, and can be used as an approach to teaching material concepts to develop students' analytical thinking skills in the city of Mecca. In addition, [Pratama et al. \(2022\)](#) revealed that if learners can follow the process of analytical thinking skills, namely the ability to distinguish, organize, and connect, then they can form concepts within themselves to analyze every problem they will face, leading to the development of higher-level thinking skills. This analytical thinking ability can be developed by giving answers directly or in writing.

Learning outcomes were assessed using multiple-choice test questions totaling 23 items, each with 5 answer choices. N-Gain learning outcomes for experimental and control class students are shown in Figure 3.

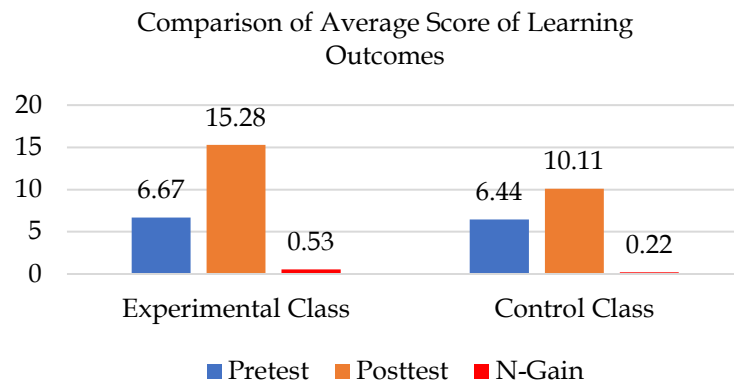


Figure 3. Average learning outcomes score

Based on Figure 3, there is a significant difference in the average scores between the experimental and control classes for learning outcomes. The average N-gain score for the experimental class was 0.53 in the medium category, higher than the N-gain score of the control class, which was 0.22 in the low category. It can be concluded that learning with infographic media has an effect and is more effective in improving student learning outcomes. This aligns with the opinion of [Darmawan et al. \(2021\)](#), who found that, compared to PowerPoint media, infographic learning media can improve learning outcomes because the content displayed in infographics is more engaging and easier to understand. In addition, infographics implemented in learning can improve learning outcomes, with an average presentation value of 87.9% in the very good category ([Sari et al., 2018](#)).

Furthermore, when viewed in terms of the average N-gain scores for learning outcomes of experimental and control class students, based on learning outcome indicators according to [Anderson & Krathwohl \(2010\)](#), the results for the cognitive dimension are shown in Figure 4.

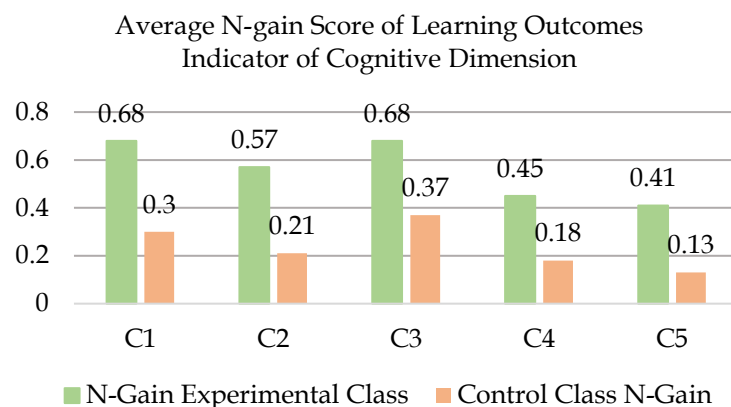


Figure 4. Average N-Gain score learning outcomes cognitive dimension indicator

Figure 4 shows that the N-gain values obtained for each cognitive dimension indicator in the experimental class are in the medium category. In the control class, dimensions C1 and C3 are in the medium category, and C2, C4, and C5 are in the low category. The N-gain value of the C1 dimension includes the ability to recognize and remember. The experimental class gets a score of 0.68, while the control class gets a score of 0.3. This shows that the use of infographics helps students more easily remember learning material because they contain simple sentences combined with attractive images or graphic designs. This aligns with [Darung et al., \(2020\)](#), who found that infographic learning media can increase attractiveness and make it easier and faster for students to learn and remember the concepts of the material being studied. In addition, infographics include illustrative images that can help students remember learning materials ([Martini & Sueca, 2023](#)).

The C2 cognitive dimension includes students' ability to understand. The experimental class has a higher N-gain value of 0.57, which is included in the medium category, than the control class, which has an N-gain value of 0.21, which is included in the low category. This shows that the use of infographics as learning media is effective in helping students understand the material, as they contain visualizations and simpler sentences that are easily understood. Infographic learning media, supported by illustrations, symbols, icons, and other learning materials, can train students' ability to understand, identify, and draw conclusions from a problem they have learned ([Mawardani et al., 2022](#)).

Dimension C3 includes the ability to apply or implement. The experimental class has an N-gain of 0.68, while the control class has an N-gain of 0.37. This shows that students who receive treatment with infographic learning media can more easily determine a concept in learning materials because infographic media helps them understand the material, which affects memory and reasoning power. Furthermore, in the C4 dimension, which includes the ability to analyze, the experimental class obtains an N-gain of 0.45, while the control class obtains an N-gain of 0.18. Students have a high attraction to the use of infographics in learning because it can help them improve their understanding and learning of materials that they consider complicated and challenging, so that critical thinking skills, including analyzing, and students' understanding of scientific topics also grow because they participated in classroom activities ([Dewi et al., 2023](#)).

Finally, in the C5 dimension, which includes the ability to evaluate, the experimental class obtains an N-gain of 0.41, while the control class obtains an N-gain of 0.13. The N-gain score for the experimental class is higher than that of the control class, indicating that this infographic learning media affects the C5 learning outcome indicator, namely, evaluating. Providing material in the form of systematically arranged, narratively structured infographics that combine various supporting elements makes it easier for students to understand new information and to make decisions. This is supported by research conducted by [Provvidenza et al. \(2019\)](#), who found that the use of infographics can fulfill 91% of learners' knowledge needs and provide 87% of new knowledge. This study also shows the potential impact of infographics as a learning medium that can meet the knowledge needs of many audiences. In addition, infographics can oversimplify when summarizing comprehensive scientific reports or information into a single visualization ([Dewi et al., 2023](#)).

The average N-gain score for student learning outcomes in experimental and control classes, based on indicators from the knowledge dimension according to [Anderson & Krathwohl \(2010\)](#), is shown in Figure 5.

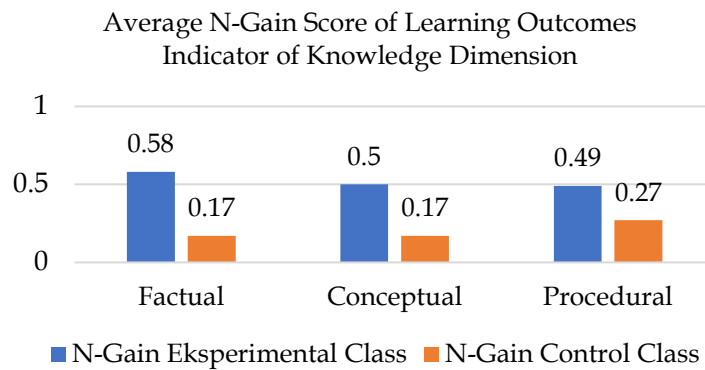


Figure 5. Average N-Gain score learning outcomes knowledge dimension indicator

Based on Figure 5, there is a significant difference between the experimental and control classes in the knowledge dimension. The indicator with the highest N-gain score is the factual knowledge indicator, where the experimental class has an N-gain of 0.58 in the medium category, higher than the control class's N-gain of 0.17 in the low category. This shows that when students are taught facts, it is more effective to present them in an infographic. This assumption is reinforced by Otten ([Wibowo & Toni, 2022](#)), who states that infographics are an effective medium for conveying complex facts and data in a visually appealing format, enabling quick delivery and making the information useful for decision-making.

In the conceptual knowledge indicator, the experimental class N-gain value was 0.50 while the control class N-gain value was 0.17. Furthermore, in the procedural knowledge indicator, the experimental class had an N-gain of 0.49, while the control class had an N-gain of 0.27. Based on these data, it can be concluded that the use of infographics as learning media affects learning outcomes, as indicated by indicators of the knowledge dimension. This is because the N-gain value in the experimental class, across factual, conceptual, and procedural indicators, is higher than that of the control class. The learning process using infographic media is also considered better and more effective than *PowerPoint*. This is in accordance with [Masluhah et al. \(2022\)](#) who revealed that infographics are the most effective learning media for communicating information in the era of digital technology, such as today, because the material presented is more interesting and easier to read and understand. After all, it is presented in the form of images, diagrams, tables, and graphs, combined with bright, attractive fonts and colors that are appealing to students. In addition, through this infographic, learning media can motivate and engage students in the classroom, making the learning process less boring and enabling them to improve their learning outcomes ([Darmawan et al., 2021](#)).

Conclusion

Based on the data analysis, it can be concluded that the infographic learning media influences analytical thinking skills and student learning outcomes in the genetic substance material in class XII MIPA MAN 3 Tasikmalaya City, during the 2023/2024 academic year. This is shown by comparing analytical thinking ability scores and learning outcomes between students in the experimental and control classes. Apart from that, the ANCOVA results showed a significance value of 0.000, which means that a significance <0.05 indicates that H_0 is rejected and H_a is accepted.

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