

Revolutionizing Biology Education: Leverage GIF Technology to Elevate Student Academic Achievement

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ABSTRACT

This study determines the effect of learning that integrates visual Graphic Interchange Format (GIF) on the academic achievement of fourth grade students for Biology subjects. The sample of this study consists of 48 fourth form students in the Seremban district who take Biology subjects. This study is limited to the fourth grade Biology learning topic (Nutrition and Human Digestive System). The instrument for this study is a set of pre-post achievement test questions for Biology subjects. The design of this study is quasi-experimental. Data is analyzed using Paired Sample t-Test and Independent Sample t-Test. The analysis shows that there is a significant difference between the mean score of the post-achievement test for the treatment group and the mean score of the post-achievement test for the control group ($t=9.147$, $df=46$, $p=0.001$). Results Independent sample t-test analysis of the post-test between the treatment and control groups shows a significant difference in the mean post-test achievement for the treatment group and the control group. The achievement of the treatment group was better than the control group proved that learning Biology through GIF technology can increase the achievement of fourth grade students in the subject of Biology. It is hoped that the use of GIF will also help Biology teachers to produce an effective teaching and learning process such as using GIF to explain instructions or provide feedback to students in quiz or game activities.

Keywords: GIF, Academic Achievement, Biology Education, STEM

INTRODUCTION

This document is a template. 21st century education is undergoing rapid transformation with the application of digital technology to enhance the learning experience. One of the increasingly popular innovations is the use of Graphic Interchange Format (GIF) as an interactive visual communication tool. GIFs, which were originally created for entertainment, have now been adapted in education to help visualize abstract and complex concepts, especially in subjects such as Biology and Physics. According to a study by Lim and Aziz (2024), GIFs help students understand difficult biological processes such as mitosis and photosynthesis in a more interactive and understandable way. This technology also increases student engagement by presenting concepts visually and dynamically, making learning more enjoyable. Hence that, students who have a visual learning style can understand a Biology concept faster. This is because GIF convey ideas clearly and quickly without the need for long text.

In addition to helping understanding, GIFs also play an important role in increasing students' interest in learning. According to Robinson et al. (2023), visualization through GIFs can make difficult concepts more interest and easy to follow, increasing students' interest in topics they consider challenging. For example, using GIFs to explain the movement of molecules in the process of diffusion or osmosis helps students see real movement, not just theory. This is in line with the study of Tan et al. (2023) who found that 75% of students showed increased interest in learning science after being exposed to learning using GIFs.

Although GIFs provide many benefits, their use should be balanced so as not to cause excessive cognitive load

to students. Research by Smith and Jones (2022) emphasized that although GIFs improve understanding, teachers should ensure their use is relevant and does not distract students from focusing on the main content. A balanced approach is needed for GIFs to truly help enrich the learning experience without causing confusion. Therefore, modern education that uses GIF technology needs to be accompanied by the right pedagogical strategy so that its effectiveness can be maximized.

According to studies by Dawson (2021), learning with dynamic visuals such as GIF helps in improving information retention. GIF that display simple animations of certain biological processes can help students remember the steps of the process better than static images. GIF can also be used as a technology-based learning tool. Students can access GIF online or from digital learning materials for self-study outside of class, reinforcing their understanding. Overall, GIF as a secondary school Biology learning tool offers advantages in attracting interest, improving understanding, and strengthening students' visual memory, especially when used in the context of modern educational technology.

PROBLEM STATEMENT

Previous research findings have shown a relationship between students' low performance in biology and students' perceptions of difficulty in certain topics (Edeh & Martha, 2020; Ezechi, 2019). Furthermore, students' learning methods in biology that contribute to the low achievement mentioned earlier are largely linked to the perception of biology as a boring subject. This perception stems from rote learning being the main technique of students that burdens students to remember many terms and facts (O'Leonard, 2014). The popular rote learning method among students further affects academic performance in biology due to students' limited exposure to problem-solving techniques and critical thinking skills. The effect of rote learning methods contributes to a decrease in test scores for problem-solving tasks in TIMSS (Ministry of Education Malaysia, 2018).

Apart from student problems, teacher problems also contribute to students' difficulties in mastering biology knowledge and students' low achievement in assessments and examinations. Teachers still practice lecture teaching strategies (chalk and talk) in the classroom because they believe that this strategy can help students focus (Tay & Salmiza Saleh, 2020) and during learning, students rely solely on the use of textbooks and teacher explanations (Nur Fazirah Rahim & Siti Nur Diyana Mahmud, 2018). Weaknesses from the use of inappropriate media or visuals in learning materials can negatively affect student achievement. According to Zamri Mahamod (2012) through Harlina Ishak et al., (2017), conventional teaching techniques based on lectures based on notes that are still practiced cause topics to become uninteresting and students find it difficult to pay attention to the learning content.

RESEARCH OBJECTIVES

Research Objectives

To study the problems discussed, the the objective of this study is to; Identify the effectiveness of using GIF on the achievement of Form Four Biology students

METHODOLOGY

21st century education is undergoing rapid transformation with the application of. In this study, researchers use quantitative approach with a quasi-experimental design involving 48 fourth grade biology students in Seremban district, Negeri Sembilan as a sample. The study sample was divided into treatment and control groups. All samples were given a pre-achievement test to find out the students' initial knowledge level. For the treatment group, the sample was given an exposure to an active learning session through visual Graphic Interchange Format (GIF), while for the control group, the sample was given a conventional learning session with the Biology subject teacher. A quasi-experimental design can see the effectiveness of a teaching method after the sample has experienced it. Therefore, after undergoing GIF learning (treatment group), conventional learning with a teacher (control group), all samples were given a post-achievement test.

Population and Sampling

The population of this study is form four biology students in Seremban district. This study used cluster sampling technique. One class in one school was used as the treatment group while one class in another school was used as the control group. Both groups consist of 24 students.

Instrument

Two instruments used in this study; pre-achievement test and post-achievement test as well as a questionnaire on the level of student interest in the subject of Biology. The pre-achievement and post-achievement tests contain 20 objective questions. This instruments have Content Validity Index (CVI) in a score of 1.00, indicating high validity (Davis, 1992).

RESULTS AND DISCUSSION

Table 1 shows the paired sample t-test analysis of the pre- and post-tests of the treatment groups.

Table I. Paired Sample T-Test Analysis Of Pre- And Post-Test Treatment Groups

Students Achievement				95% CI of the difference		t	df	p
Pre tesT		Post test		Lower	Upper			
M	SD	M	SD					
28.25	10.796	71.54	11.25	-49.218	-37.365	-15.110	23	<.001

Based on table 1, the results of this t-test analysis show that there is a significant difference in the mean pre- and post-test achievement of the treatment group. This has been proven where the significant value of this analysis is less than 0.001 ($p < 0.05$) so H_01 is rejected and H_{A1} fails to be rejected. The use of GIF can have a positive impact on student achievement by improving critical thinking (Akbar, 2022) and this improvement in skills can be seen from the mean difference of 43.29 in the pre- and post-treatment group achievement test. The large mean increase through this GIF visual learning session shows that GIF is very effective and appropriate in learning and teaching Biology subjects among fourth grade students. Pupils understand learning more easily and at the same time can improve their academic achievement for Biology subjects in particular.

Table 2 shows the paired sample t-test analysis of the pre-test and post-test of the control group.

Table II. Paired Sample T-Test Analysis of The Control Group's Pre-Test and Post-Test

Students Achievement				95% CI of the difference		t	df	p
Pre tesT		Post test		Lower	Upper			
M	SD	M	SD					
26.88	9.670	33.79	16.795	-11.705	-2.128	-2.988	23	.007

Based on table 2, the results of this t-test analysis show that there is no significant difference between the pre- and post-test achievement mean for the control group. This has been proven where the significant value of this analysis is 0.007 ($p < 0.05$) then H_02 is rejected and H_{A2} fails to be rejected. However, the mean of the pre-achievement and post-achievement test still shows a slight increase, which is 6.91. This shows that learning Biology conventionally with the teacher also increases the academic achievement of students for the subject of Biology although the increase is little compared to the learning session through GIF.

Table 3 shows the independent sample t-test analysis of the pre-test between the treatment and control groups.

Table III. Independent Sample T-test Analysis of the Pre-test between the Treatment and Control Groups

Students Achievement				95% CI of the difference		t	df	p
Treatment		Controll		Lower	Upper			
M	SD	M	SD					
28.25	10.796	26.88	9.670	-4.580	7.330	0.465	46	.644

Based on table 3, this t-test analysis shows that there is no significant difference between the mean pre-test achievement of the treatment group and the control group. This has been proven where the significant value of this analysis is 0.644 ($p > 0.05$) so H_03 fails to be rejected. This suggests that the treatment and control group samples have an equivalent level of knowledge about this topic is limited.

Table 4 shows the independent sample t-test analysis of the post-test between the treatment and control groups.

Table IV. Independent Sample T-test Analysis of the POST-test between the Treatment and Control Groups

Students Achievement				95% CI of the difference		t	df	p
Treatment		Controll		Lower	Upper			
M	SD	M	SD					
71.54	11.256	33.79	16.795	29.443	46.057	9.147	46	<.001

Based on table 4, this t-test analysis shows a significant difference in the mean post- test achievement for the treatment group and the control group. This has been proven where the significant value of this analysis is less than 0.001 ($p < 0.05$) so H_04 is rejected and H_{A4} fails to be rejected. The achievement of the treatment group was better than the control group because the use of GIFs focused on the delivery of relevant information without additional distractions and reduced extrinsic cognitive load so students understood scientific concepts and learning content easily.

CONCLUSION

In conclusion, Graphic Interchange Format (GIF) has emerged as one of the most effective visual communication tools in improving student achievement, especially in dynamic and complex subjects such as Biology. GIF provides the main advantage of its ability to visualize concepts that require animation to aid understanding. Through the use of GIFs, concepts such as Nutrition and Human Digestive System can be better explained and easily understood by students.

In addition, learning Biology through GIF visuals can show the steps of the biological process in a row and can make it easier for students to understand a complex concept by seeing repeated movements. This situation can produce students who better understand the concept of Biology and at the same time can improve student achievement in the subject of Biology.

Through the GIF as well, students will tend to a visual learning style where this learning style can help convey information in a simple and compact format. It makes it easier for students to remember key information faster than a lengthy explanation. In addition, the use of GIFs is also easily accessible and used in digital learning materials such as PowerPoint presentations, websites, and e-learning applications without the need for special plugins.

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