

The effect of different types of infographics on students' learning motivation in learning biology

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Article Information	Abstract
Keywords: Static infographics; Animated infographics; Interactive infographics; Learning motivation Keywords: Infografis statis; Infografis animasi; Infografis interaktif; Motivasi belajar History: Received : 11/01/2025 Revised : 28/01/2025 Accepted : 10/02/2025 Published : 20/02/2025	Students' success in achieving learning success is strongly influenced by learning motivation. This motivation can arouse students' interest, curiosity and enjoyment of learning materials. The main problem in learning biology related to motivation is using monotonous and less innovative media that makes students less motivated and the learning process less effective. Therefore, learning media is needed to increase students' motivation to learn. This study aimed to analyze the effect of static, animated and interactive infographics on the biology learning motivation of class XI SMA Negeri 3 Takalar students on the material of the circulatory system. The research design used was a true experiment with a pretest-posttest control group research design. The number of samples in this study was 144 students, consisting of four classes. The study's results with hypothesis testing using the ANCOVA test showed a significant effect of static, animated, and interactive infographics on students' biology learning motivation with a significance value of $p < 0.05$. LSD's further test results show that the three types of infographics have the same effect and are different from handouts as a control. The results of this study produced visual, audio-visual and interactive-based learning media. This research makes a significant contribution to the field of education, especially in learning biology, by providing an understanding of the use of technology and learning media in the form of visualization of learning materials that affect student learning motivation. Abstrak. Keberhasilan peserta didik dalam mencapai keberhasilan belajar sangat dipengaruhi oleh motivasi belajar. Motivasi ini dapat membangkitkan minat, keingintahuan, dan rasa senang peserta didik terhadap materi pembelajaran. Permasalahan utama dalam pembelajaran biologi yang berkaitan dengan motivasi adalah penggunaan media yang monoton dan kurang inovatif, sehingga membuat peserta didik kurang termotivasi dan proses pembelajaran menjadi kurang efektif. Oleh karena itu, diperlukan media pembelajaran yang dapat meningkatkan motivasi belajar peserta didik. Penelitian ini bertujuan untuk menganalisis pengaruh media pembelajaran infografis statis, animasi, dan interaktif terhadap motivasi belajar biologi peserta didik kelas XI SMA Negeri 3 Takalar pada materi sistem peredaran darah. Desain penelitian yang digunakan adalah true experiment dengan desain penelitian pretest-posttest control group. Jumlah sampel pada penelitian ini sebanyak 144 peserta didik yang terdiri dari empat kelas. Hasil penelitian dengan uji hipotesis menggunakan uji ANCOVA menunjukkan adanya pengaruh yang signifikan infografis statis, animasi, dan interaktif terhadap motivasi belajar biologi peserta didik dengan nilai signifikansi $p < 0,05$. Hasil uji lanjut LSD menunjukkan bahwa ketiga jenis infografis tersebut memiliki pengaruh yang sama dan berbeda dengan handout sebagai kontrol. Hasil penelitian ini menghasilkan media pembelajaran berbasis visual, audio-visual, dan interaktif. Penelitian ini memberikan kontribusi yang signifikan dalam bidang pendidikan khususnya dalam pembelajaran biologi, dengan memberikan pemahaman mengenai pemanfaatan teknologi dan media pembelajaran berupa visualisasi materi pembelajaran yang berpengaruh terhadap motivasi belajar peserta didik.

A. Introduction

Motivation is an important aspect that energizes and directs learners' behaviour in learning, including goals, beliefs, perceptions, and expectations. Motivation is necessary for academic success, lifelong learning, and social engagement. Teachers face a huge challenge in motivating learners to actively engage in learning, work effectively, and develop their potential. Motivated learners are more likely to achieve academically and have positive behaviours than those who are not motivated (Held & Mejeh, 2024; Li et al., 2024; Narca & Caballes, 2021).

The main problem in the learning process related to motivation lies in using learning media that tends to be monotonous and less innovative, such as only relying on package books. This makes students less motivated and feel bored during learning, making the material difficult to understand (Alamsyah et al., 2022). This is by research of Arimbawa (2020) that the learning process is less effective because teachers lecture more often without involving students, facilities and infrastructure are not optimal, such as LCDs that are rarely used, and there is a lack of learning innovation to improve the quality of the teaching and learning process.

Teachers can use digital media technology to create more interesting learning materials to increase learners' motivation. Digital media has been proven effective in improving skills, motivation, self-learning ability, learning effectiveness, and learner satisfaction (Chang, 2021). Research by Rahmawati et al. (2021) shows that digital media positively impacts students' learning motivation. This is due to the attractive media presentation and the teacher's role in creating a pleasant learning atmosphere.

The use of media in the learning process will also have a positive influence on students in terms of increasing learning motivation. Utilizing available technology to make the learning process more effective, efficient, and not boring (Puspitarini & Hanif, 2019). The use of learning media is also closely related to increasing students' learning motivation (Adnan et al., 2012). Good learning media must be attractive, easy to use, support learning objectives from trusted sources, and be arranged systematically (Alamsyah et al., 2022).

In the learning context, through visual media, learners can realize ideas, think about predefined meanings, and organize their thinking process. Visualization of information is also a method that allows information to become more visible and create meaning in learners' minds (Ozdamli et al., 2016). Learning media with the advantage of visual aspects, attractive images or illustrations, ease of creation and operation are infographics. According to Putra (2020), only three types of infographics are commonly known: static infographics, animated infographics, and interactive infographics.

Static infographics are only in images and do not move (static) (Julia, 2021). Static infographics can be said to be infographics that have a single image with the aim of communicating a specific message (Alrajhi, 2020). This static infographic is the most common and simple infographic design. The final design is usually as a static image file (jpg, png, gif, etc.) for easy viewing in a browser or as a PDF file (Krum, 2014). In a learning context, using static infographics will provide learners with multiple opportunities to repeat without information overload to improve retention and understanding (Alsaadoun, 2021).

Animated infographics are digital media content, especially explanatory videos, that combine information or data displayed in graphs, diagrams, and statistics to make the information easier to understand (Kadir et al., 2023). Animated infographics include motion or animation that can only be displayed on video screens, through YouTube, TV adverts, and other video media channels (Holt et al., 2020). Elements and data in this type of animation are in continuous motion (Afify, 2018). Animated infographics animate audio-visual items in a pile of information to be conveyed correctly and interestingly by considering the elements of communication, visual communication, and graphic design (Delil, 2015). In animated infographics, information is presented progressively in a linear sequence, and animation and video are used (Pinto, 2017).

Interactive infographics give the reader control over the data or visualization being displayed. Interactive infographics are also popular because they keep the reader engaged with the data longer than static infographics (Krum, 2014). Control in the previous definition, means having interaction techniques, such as clicking, sliding, dragging, flipping, hovering, and zooming (Greussing & Boomgaarden, 2021). Interactive infographics can be a learning tool, especially in outlining steps or procedures to facilitate learners' understanding (Polowsky & Steciuch, 2020). The interactive infographic is presented non-linearly with interactive mechanisms that allow information to be presented selectively based on user choice (Pinto, 2017).

Teaching materials motivate learners to learn and activate and maintain learning behaviour (Adnan et al., 2019). The use of infographics can influence learning motivation. This is in line with the research of Liana et al. (2023) which shows that infographic learning media significantly increases student learning motivation. Using infographics makes learning more exciting, interesting, and not boring. When using infographics, students feel happy and can more easily understand the learning material because the infographic presentation attracts their attention. The study by Nhan & Yen (2021) shows that the application of infographic-based learning strongly influences students' motivation. Infographics can be an

alternative reading activity to help learners understand texts more easily because they integrate words and images to present complex information quickly and clearly. At the same time, infographics make it easier to understand than words alone and are considered a support tool that increases learning motivation. The research is also supported by Wu & Kuwajima (2022) that learners show high learning motivation in using infographics in learning, and learning motivation is higher after infographics are added to textbook teaching. According to research by Parveen & Husain (2021), infographics make it easier for learners to be motivated to read, analyze data, and draw conclusions more easily and thoroughly.

Based on the theoretical studies and the problems described above, this study aims to determine the effect of static, animated, and interactive infographics on students' biology learning motivation in class XI circulatory system material. This study also proposes a hypothesis that there is a statistically significant effect at the 0.05 level in the biology learning motivation of students due to static, animated, and interactive infographics.

B. Material and method

This study used a true experimental method with a pretest-posttest control group research design (the research design can be seen in Figure 1). This study's population was all 12 classes of grade XI students at SMAN 3 Takalar. The sample size was 144 students, consisting of 4 classes. Sampling in this study used a simple random sampling technique. This research focuses on systematic data collection and analysis to determine the effect of the three types of infographics on learning motivation.

The instrument used to assess learning motivation is a questionnaire. This questionnaire is used to obtain information about students' learning motivation before and after using infographics. The learning motivation questionnaire refers to the ARCS model (Keller, 2010), which refers to attention, relevance, confidence, and satisfaction. The questionnaire used by researchers was adopted from the research of Adnan et al. (2014), and then modified

and adjusted based on the aspects, media, and materials used. The questionnaire consists of twenty statements with a structured or closed questionnaire type, meaning that the answers to the statements have been provided so that respondents can choose the answers strongly agree, agree, disagree, and strongly disagree by giving a checkmark according to the situation. The number of respondents was 36 students divided into four classes. To ensure clarity and validity, the media and instruments were examined by two experts from academia who provided feedback and input. The results of the validity of the media and questionnaire can be seen in Table 1.

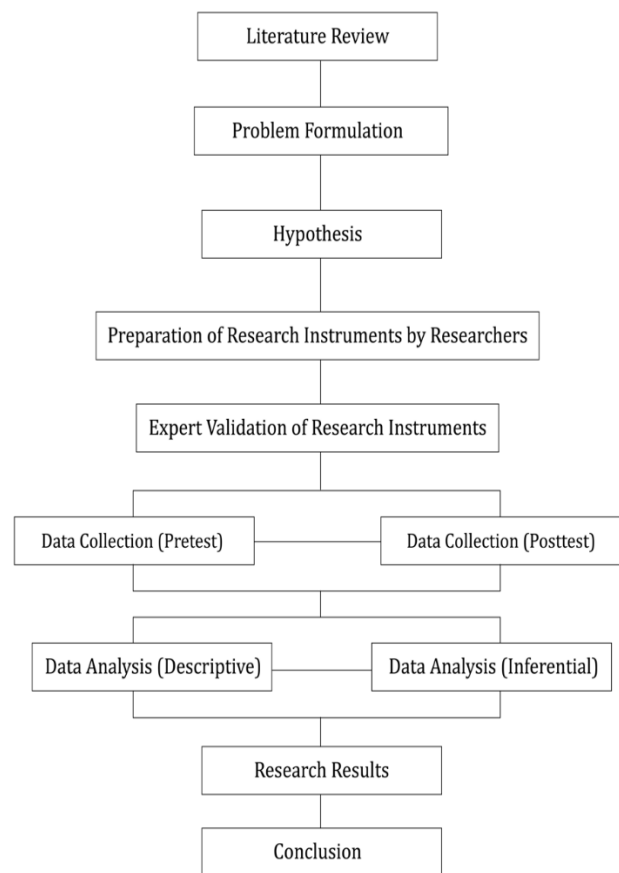


Figure 1 Research design

Table 1 Validity of infographic media and learning motivation questionnaire

Validity of infographic media		
Assessment aspect	Assessment score	Category
Material	4.83	Very valid
Design/display	4.67	Very valid
Language	4.17	Very valid
Average	4.56	Very valid
Validity of learning motivation questionnaire		
Format	4.75	Very valid
Content/motivation aspect	4.90	Very valid
Language	4.25	Very valid
Average	4.63	Very valid

The inferential test to test the hypothesis used is the ANCOVA test related to the effect of infographics on learning motivation. Then continued with the LSD (Least Significant Difference) Test to see the difference in the influence of each infographic. Before performing the hypothesis, an initial test was conducted to determine the normality and homogeneity of the research data. The results of the overall normality test showed a range of p values ranging from 0.140 to 0.200, indicating that all data were normally distributed (more detailed results can be seen in Table 2). Meanwhile, the overall data homogeneity test resulted in p-values ranging from 0.169 to 0.232, indicating homogeneous data in all groups (more detailed results can be seen in Table 3).

C. Results and discussion

Implementation of infographic media

Learning begins by conveying learning objectives and motivating students. Then, present and deliver the material. Experimental class 1 was presented with static infographics, experimental class 2 with animated infographics, experimental class 3 with interactive infographics, and control class with handouts. Afterwards, learners are organized into groups to complete learner worksheets and present the results.

The infographic learning media was implemented in three classes as experimental classes.

Classes taught with static infographics are presented in pdf file format, given and displayed on each learner's smartphone to be used as reading material. Static infographics only contain images and no further movement. Classes taught with animated infographics were presented in mp4 file format and also given to be displayed on each learner's smartphone. Classes taught with interactive infographics were presented in PowerPoint file format and displayed using a projector in front of all learners. Interactive infographics are infographics where the presentation of the material is based on the user's command or will, meaning that there are interaction techniques, such as clicking, zooming and dragging.

Meanwhile, classes taught with handouts were presented by giving printed handouts at every meeting. Implementing infographics in the three experimental and control classes used the same material: blood components, blood clotting, blood groups, heart structure, blood vessels, and blood circulation processes.

The descriptive analysis results showed students' average motivation to learn in the very strong category in all three infographics based on the categorization interval. While in the handout, the average motivation of students is in the strong category. These results indicate there is a significant difference in influence (more detailed results can be seen in Table 4).

Table 2 Normality test of learning motivation scores

Data		Kolmogorov-Smirnov normality test			Description
		Statistics	df	p	
Experimental class 1	Initial motivation	.091	36	.200*	Normally distributed
Experimental class 2		.105	36	.200*	Normally distributed
Experimental class 3		.090	36	.200*	Normally distributed
Control class		.112	36	.200*	Normally distributed
Experimental class 1	Final motivation	.106	36	.200*	Normally distributed
Experimental class 2		.129	36	.140	Normally distributed
Experimental class 3		.114	36	.200*	Normally distributed
Control class		.122	36	.195	Normally distributed

Table 3 Homogeneity test of learning motivation scores

Data	Levene's statistics	df1	df2	p	Description
Initial motivation	1.446	3	140	.232	Homogeneous
Final motivation	1.702	3	140	.169	Homogeneous

Table 4 Categories of student learning motivation scores

Interval	Category	Static infographics				Animated infographics				Interactive infographics				Handout			
		Initial		Final		Initial		Final		Initial		Final		Initial		Final	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
81-100	Very strong			22	61.10			25	69.45			19	52.78			7	19.44
61-80	Strong			13	36.10			11	30.55			17	47.22			29	80.56
41-60	Simply	34	94.45	1	2.8	13	36.11			27	75.00			23	63.89		
21-40	Weak	2	5.55			23	63.89			9	25.00			13	36.11		
0-20	Very weak																
Total		36	100	36	100	36	100	36	100	36	100	36	100	36	100	36	100

Description: N = number of students, % = percentage of learning motivation score

The effect of infographic media on learning motivation

Infographic learning media affects students' learning motivation. The value of motivation is evidenced by the use of media in classes taught with static, animated, or interactive infographics compared to classes taught with handouts. Learning motivation has several indicators: attention, relevance, confidence, and

satisfaction. The value of each indicator can be seen in Table 5. Based on the table, all indicators of learning motivation were in the moderate category in the initial motivation and were in the strong category for the relevance indicator and very strong for the attention, confidence, and satisfaction indicators in the final motivation. This shows an increase in learning motivation before and after applying infographics.

Table 5 Initial and final learning motivation indicator values

Media/indicator	Attention	Relevance	Confidence	Satisfaction
Initial motivation				
Static infographics	50.00	50.78	48.78	48.56
Animated infographics	40.22	38.44	39.11	39.89
Interactive infographics	47.00	46.33	43.33	45.89
Handout	45.89	43.89	42.00	42.89
Average	45.78	44.86	43.31	44.31
Category	Simply	Simply	Simply	Simply
Final motivation				
Static infographics	82.56	82.56	85.89	84.67
Animated infographics	85.33	85.89	84.11	86.00
Interactive infographics	81.00	81.56	79.78	85.78
Handout	76.78	72.44	73.00	72.44
Average	81.42	80.61	80.70	82.22
Category	Very strong	Strong	Very strong	Very strong

Table 6 ANCOVA test of the effect of infographic media on learning motivation

Source	Type III sum of squares	df	Mean square	f	p
Intercept	14219.019	1	1421.019	193.488	.000
Initial motivation	24.928	1	24.928	.339	.561
Media	2955.958	3	985.319	13.408	.000
Error	10214.794	139	73.488		
Total	963488.000	144			

The effect of infographic learning media applications on students' learning motivation can be seen in the ANCOVA test results (Table 6). The results of the ANCOVA test using the test of the effect between subjects on the media value of $f = 13.408$ with a p-value of $0.00 < 0.05$ (significance value is less than 0.05). Thus, there is a significant effect on learning motivation between students taught with static, animated, and interactive infographics.

The significant effect of infographics on learning motivation is inseparable from the similar visual characteristics of all infographics with a strong impact. Although there are differences, all infographics have the same visual characteristics and are different from text-based and printed handouts.

The visual base, namely images on static infographics, will make learners more excited about learning, making learners interested in learning and reducing boredom while learning. With the loss of boredom, learners focus only on learning and understanding what the teacher conveys (Katona et al., 2023). This research by Mayarita et al. (2023) shows an interesting and enjoyable learning environment will make learning easier for learners and impact a better understanding of the subject matter. Visual elements

that learners already recognize, such as shapes, colours and environments, can generate longer discussions and arouse learners' motivation to learn in various subjects (Lopatovska, 2016).

Animated infographics, with their audio-visual base, affect learning motivation. Audio-visual media is a tool used in learning to create written and spoken words to convey knowledge, attitudes, and ideas in learning. Animated infographics are also a medium that can project moving images and sound to motivate learners (Manalu et al., 2023). The use of appropriate media by procedures, such as audio-visual-based media, will result in a more interesting, more interactive learning process, can help students get a more concrete learning experience, can arouse interest, can arouse learning motivation, and can present materials by their original conditions (Antoro & Sridiyatmiko, 2022).

Interactive infographics displayed in PowerPoint also affect students' motivation to learn. PowerPoint media is an interactive presentation application programme that can accommodate the sensory potential of learners so that it can display presentation files that will attract listeners and instantly listen to what is conveyed in the presentation

(Suharti et al., 2022). The interactive nature of media is a major factor that generates learning motivation. This media is made by combining and presenting various objects in one learning, namely multimedia-based learning media, so that the material can be digested by all learners with various learning styles, such as visual, audio and kinesthetic (Saepuloh et al., 2022). Interactive infographics are interesting and effective media because the presentation of information uses photos and text and a combination of

illustrations, videos, animations, and interactivity (Madaniyya & Alfarisi, 2020).

The LSD further test shows the difference in the effect of each type of infographic and handout (Table 7). Based on this test results, it is known that the infographics presented in each class have the same or not significantly different effects on students' learning motivation. This is different from classes taught using handouts, which have a different or significantly different effect on all types of infographics.

Table 7 LSD further tests the effect of infographic media on learning motivation

Variables	Media	Mean difference	p	Testing	Description
Learning Motivation	Static infographics and animated infographics	2.152	.368	Sig. > 0.05	Not different
	Static infographics and interactive infographics	1.606	.441	Sig. > 0.05	Not different
	Animated infographics and interactive infographics	3.768	.085	Sig. > 0.05	Not different
	Static infographics and handouts	9.824*	.000	Sig. < 0.05	Different
	Animated infographics and handouts	11.976*	.000	Sig. < 0.05	Different
	Interactive infographics and handouts	8.218*	.000	Sig. < 0.05	Different

The similarity of the three infographics in influencing learning motivation is due to their visual representation style, which is closely related to the natural human tendency to process and remember visual stimuli more easily than text or verbal explanations. In addition, infographics allow the presentation of information in a hierarchical or structured manner in a logical order, allowing learners to understand the bigger picture of the material (Habibi et al., 2023). Infographics are one of the applications of learning technology that can motivate learners to learn. This statement is based on research by Shemy (2022) which shows the importance of technology in increasing students' motivation to improve their achievement and willingness to learn. Using infographics to present scientific concepts to learners is particularly important as this contributes to self-directed learning. The effect of infographics on learners' learning motivation is also because infographics combine text with images. According to research by Nhan & Yen (2021), infographics integrate words and graphics to present complex information quickly and clearly. At the same time, infographics facilitate comprehension rather than words alone and are considered a supportive tool that increases learners' motivation to read. Infographics also have the advantage of being attractive and creative. This makes learners motivated and comfortable to learn. The same statement was made by Liana et al. (2023) who stated that infographics make learning more interesting, exciting, and not boring. When using infographics, learners say that they feel happy and can understand the learning material more easily because the

presentation of infographics attracts their attention. This makes learners more focused and easier to understand the material. According to Khaeranda et al. (2024), interesting and creative visuals can trigger learners' interest in exploring the material. Well-designed infographics can produce more interactive and fun learning activities to encourage learners to learn. The elements contained in infographics are also one of the factors that have a positive effect on students' learning motivation. This is in line with the research of Aguilar & Panoy (2022) which states that the colour, size, and icons used in learning materials in infographics also need to be considered to attract readers' interest.

There is a significant difference in the effect of handouts when compared to all types of infographics. The difference is that the writing-based handout has a less significant effect, causing low learning motivation. According to Hoerudin (2023), one of the causes of the low reading ability of students is that the learning process still relies on conventional media, which tends to make students less active. According to Mulyosari & Khosiyono (2023), learning media can reduce the passive attitude of students to be active and clarify the information conveyed so that it is not only verbal (both oral and written). Using varied learning media or more than just text can encourage students' activeness in the learning process. In addition, interesting and innovative media can also increase learning motivation and improve student learning outcomes (Puspitarini & Hanif, 2019).

D. Conclusion

Static, animated, and interactive infographic learning media significantly affect students' learning motivation in class XI SMA Negeri 3 Takalar, especially on the material of the circulatory system. The ANCOVA test results show the significant effect of the three types of infographics, and the LSD test results show that the three infographics have the same and different effects when compared to handouts. The findings of this study provide insights for educators and teachers in choosing the right teaching media to increase students' learning motivation, which is one of the factors that also affect learning success. Teachers are expected to develop innovative digital learning media based on visual, audio-visual, and interactive content, such as infographics. The findings also serve as a basic reference for further research on students' learning motivation in education, especially in learning biology, because this research was only conducted on senior high school students. The researcher suggests that future researchers conduct research at other education levels, such as elementary school, junior high school, or college, and use different materials to see if the same results apply to different age groups and materials.

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