



## Student Creativity Through Animated Cartoon Images Using Artificial Intelligence: Does It Affect Indirect Creativity Indicators?

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**Abstract:** This research aims to see the influence of cartoon animation media on student creativity in nutrition and food courses. This research uses quantitative descriptive methods. This research was carried out at UIN Sulthan Thaha Saifuddin Jambi, with a research population of 47 students who took nutrition and food courses in semester V. The sample in this study used a total sampling technique, namely, the entire population that was the research subject. The data collection technique uses an indirect creativity questionnaire survey on five indicators using a Likert scale with a total of 20 questions. Based on the research results, data was obtained that the use of Artificial Intelligence-based cartoon media can influence student learning creativity in nutrition and food courses with an average score of 4.46 in the good category, where in detail, each indicator, such as the Investigation Group, has an average score of 4.44 in the good category, the Pre-Knowledge Indicator with an average value of 4.13 in the Good category, then the Influence of Culture and Values indicator with an average value of 4.83 in the good category, the Motivation indicator with an average value of 4.95 in the good category and the Self-Esteem indicator with an average value of 3.87 in the pretty good category. The highest creativity indicator in this research is Motivation in the good category, while the lowest in this research is the Self-Esteem creativity indicator in the quite good category.

## INTRODUCTION

Nutrition and food is a subject that is often understood as an interesting subject, because for today's children their attention to lifestyle has increased in line with current developments in information and technology. Cartoons are an interesting spectacle for children and can increase their enthusiasm for learning (Divanji *et al.*, 2023; Skulmowski, 2023; Zheng *et al.*, 2024). In biology learning, it is very easy to attract students' attention, one of which is showing animated cartoons about health problems, many of which are scattered on the internet, which can be used in the learning process. For today's students, explaining using symbols such as animation, researchers believe it can increase students' enthusiasm for learning.

Learning media such as cartoons are very easy to find and can be used as a learning tool that combines teacher abilities with the availability of technology which makes it easier for teachers to choose appropriate images, especially nowadays there are AI

(Artificial Intelligence) applications that can help facilitate several activities (Ouyang & Jiao, 2021; Yerushalmi *et al.*, 2010), one of which is creating animated images (El-mashad & Hamed, 2022; Lijanporn & Khlaisang, 2015; Yoon *et al.*, 2017). Learning creativity is very important. Basically there are two types of indicators of learning creativity, namely direct and indirect learning creativity (Vandeleur *et al.*, 2006) which results from encouragement or students' understanding of an event.

Teaching using cartoon images can be used to convey information from lecturers to students and from students to the people who will receive it, or vice versa so that their enthusiasm increases for the better (Iftene *et al.*, 2018; Lijanporn & Khlaisang, 2015; Tao *et al.*, 2022; Turan, 2014). In nutrition and food courses, to provide insight or the good and bad impacts of food and health problems, it can be depicted and explained using cartoon media which has an appeal for today's children, it can be in the form of objects, events, people, or a combination of all of them can be used as learning media. Cartoon media in nutrition and food learning can be a driving force for students' creativity to better understand a phenomenon (Commons *et al.*, 2023; Divanji *et al.*, 2023; Tao *et al.*, 2022; Zhang *et al.*, 2022). Their abilities will be structured and gain more meaning from the cartoon images provided during the lecture.

Cartoon media will be able to provide support in developing the learning process into a common language, which can be understood and enjoyed anywhere and always provides encouragement and better attention to students. Cartoon animated images basically help convey general messages that are interesting and increase students' attention (Guo, 2018; Tasir, 2013), so they can be understood and enjoyed anywhere (Ilin, 2022; Skulmowski, 2023; Turan, 2014). In principle, pictures actually have a lot of meaning and basically help encourage students to arouse enthusiasm and interest in learning (Mohammadi & Heidari, 2014). Helping students to be able to speak language, artistic activities and creative expressions in telling stories and helping them remember the content of the material they have studied so that activities can emerge and increase creative abilities (Dereli, 2010; Iftene *et al.*, 2018; Ilin, 2022; Madden & Alt, 2021).

Cartoon media can be a solution in 21st century learning and in fact many researchers provide information about this research, but not many provide it comprehensively, especially in nutrition and food courses. Media capabilities are considered good if the media used is able to make students focus on lectures, especially in this research, lectures on nutrition and food. Cartoon animation media can facilitate students' understanding and foster student interest as well as provide a connection between the content of the lesson material and the real world so that their enthusiasm can increase and at the same time their enthusiasm for the material also becomes better (Cook & Cowan, 2023; Creel & Frye, 2024; El-mashad & Hamed, 2022). In the learning process, well-designed learning media can arouse children's interest in learning as well as being able to encourage students' learning skills. By creating this image media, the learning process becomes fun for students.

The development of AI technology can make it easier for teachers to create animated images. Educators just need to enter the desired keywords then give directions to the images provided and it will produce images according to their wishes (Divanji *et al.*, 2023;

Lijanporn & Khlaisang, 2015). This kind of convenience can be an encouragement for teachers to create animated images that are interesting and relevant to student learning outcomes. In some conditions, cartoon animation is indeed able to provide encouragement, but sometimes if the cartoon animation media provided is repetitive, it will decrease students' enthusiasm, but if cartoon animation is provided in a variety of ways, such as using AI, then learning will be much better and more enjoyable (Canonico *et al.*, 2018; Ouyang & Jiao, 2021; Armaan Gökçearsan, 2010). The rapid development of AI can be a means of simplifying the learning process so that students' enthusiasm for learning will increase (Canonico *et al.*, 2018; Kozma, 1991; Madakam *et al.*, 2022). This research will present how cartoon imagery media has been widely used in several studies, but researchers have not yet found one that focuses on research using AI applications and especially in nutrition and food material to see how student creativity arises. This research can certainly serve as a basis for developing learning media in the future, especially in enhancing creativity, especially in Indirect Indicators of Creativity consisting of Group Interaction, Pre-Knowledge, Influence of Culture and Values, Motivation and Self-esteem, which researchers have not found specifically in indicators of creativity after using AI based cartoon learning media directly, especially in biology learning on nutrition and food material.

## METHOD

The approach used in this research is a quantitative descriptive approach. Quantitative descriptive is an approach that is able to provide an overview based on data on the number of students' understanding of an observation in the form of numbers, which can be a description of a situation (Creswell, 2012; Johnston, 2014). Quantitative data obtained from the results of student creativity surveys will later guide researchers in understanding situations or phenomena that occur to students during the learning process in nutrition and food courses using cartoon animation media assisted by AI. This research was carried out by providing AI-assisted cartoon animations in class with the aim of seeing students' learning creativity, especially in nutrition and food lectures. The population in this study were UIN Sulthan Thaha Saifuddin Jambi fifth semester students who took nutrition courses in the odd semester of the 2023-2024 academic year, totaling 47 people, consisting of 3 classes with details of class VA, totaling 12 people; VB, totaling 17 people; and VC, totaling 18 people. All the students taken were students who the researchers taught nutrition and food courses, totaling 47 people. The sampling used a total sampling technique, namely, all students who studied nutrition and food using cartoon animations assisted by AI. The AI used in this research includes Canva, Playform, Deep Dream Generator, AI Painter, NeuralStyler and others, all of which are used to assist the learning process of nutrition and food image media.

Data collection techniques were carried out through observation and questionnaires, where the survey was carried out using a questionnaire referring to indirect indicators of student learning creativity. Indicators of student learning creativity are divided into two types, namely direct indicators and indirect indicators (Vandeleur *et al.*, 2006). In this study, researchers tried to find out the influence of student learning creativity in terms of

indirect creativity indicators. Guide to indirect indicators of student creativity to see the influence of cartoon animation media based on AI refers to 5 parts of indirect indicators of creativity, namely group Investigation, Pre-Knowledge, Cultural Influences and values, , and Self-esteem (Vandeleur *et al.*, 2006). All are indicators of creativity Indirectly, students are each given 4 questions, where the questions used have been validated and adapted to the question indicators that are expected to be revealed from the research results. Researchers create their own questions by referring to the indicators and consider them through logical validation (asking for expert consideration). The questions for each indicator can be seen in Table 1.

Table 1. Indirect Creativity Questions for Nutrition and Food Course students

No	Indicator	Question
1	Group Investigation	Are you in a group taking part in providing an understanding analysis of the animation media provided?
		Is the animation media used able to make you solve group problems quickly?
		Does your group carry out analyzes that solve problems in nutrition and food?
		Do you find a deeper understanding of nutrition and food material and are able to convey it directly
2	Pre-Knowledge	Can your knowledge of the nutritional material in the test questions be understood easily?
		Are you able to know the correct answer to the food question a few moments after seeing the question?
		Have you predicted nutrition and food test questions and answers?
		Does Sola and the answers you take remind you of the AI-based cartoon image media provided
3.	Cultural Influences and value	Does the cartoon image media remind you of the living habits of people in your environment?
		Do you understand the impact that occurs if a good understanding of nutrition and food is not well understood and cultivated?
		Can the knowledge you gain be conveyed to the public regarding good nutrition and food patterns?
		Did you know that nutritional knowledge should become a habit in society?
4.	Motivation	After being given AI-based cartoon media, did you become enthusiastic about understanding nutrition and food material?
		Does the cartoon media provided by the teacher make you more enthusiastic in understanding nutrition and food material?
		Are your abilities in a group more effective in solving problems?
		Do you feel your motivation to study has increased, especially in nutrition and food processing courses?
5.	Self-esteem	Do you believe that nutrition and food must be understood and implemented?
		Are you sure that AI-based cartoon media about the negative impacts on humans if they don't adopt a healthy lifestyle will really happen?
		Do you believe in yourself that you have to live with a good diet?
		Do you believe that bad impacts will occur in individuals who do not want to pay attention to healthy eating and living patterns?

The questions in this research can be seen as in table 1, namely 20 questionnaire questions from 5 indicators. Then survey data was taken using a Likert scale with 5 types of levels (Kagerbauer & Magdolen, 2024), so that creativity from students could be

obtained directly on the 5 indicators observed. The Likert scale categories used can be seen in Table 2.

**Table 2.** Conversion of student creativity scores using a Likert scale

No	Assessment Category	Student Scores
1	Very Good	5
2	Good	4
3	Pretty Good	3
4	Not good	2
5	Very Bad	1

In table 2. It is used as a reference for the researcher's assessment when looking at the answers to the questionnaire answered by students after studying nutrition and food courses taught using AI-based cartoon media. Researchers also conducted interviews with students separately who were taken at random, where 5 students were taken from each class to ask for clarification or explanation regarding learning using AI-based cartoon media in nutrition and food courses, then the interview data would strengthen the findings from the questionnaire given by students.

## RESULT AND DISCUSSION

The findings from research results that the researchers have obtained illustrate that cartoon media, with the help of AI, can deliver extraordinary convenience and benefits in the lecture process, especially in lectures for undergraduate biology students who take nutrition and food courses. Creativity is very important in changing difficult and boring learning paradigms into interesting and fun learning (Shute & Rahimi, 2021; Zb *et al.*, 2021) , and this research tries to analyze student creativity, especially indirect creativity which consists of 5 indicator sections the Investigation, Pre-Knowledge, Cultural Influence and values, motivation and self-esteem group, where in this research the data obtained for each indicator shows that the average value is quite satisfactory in increasing student learning creativity. However, it cannot be denied that several indicators are less than optimal in improving student learning creativity. In general, the findings of students' indirect creativity can be seen in Table 3.

**Table 3.** Students' indirect creativity scores

Indicator	Average Value of Each Indicator	Category	Average value	Category
Group Investigation	4,44	Good	4,46	Good
Pre-Knowledge	4,13	Good		
Cultural Influences and values	4,83	Good		
Motivation	4,95	Good		
Self-esteem	3,87	Pretty Good		

The research findings presented by the researchers in Table 3 provide a fairly clear picture of where cartoon animation media assisted by AI is able to make a good contribution to the learning outcomes of Biology students, especially in nutrition and food courses, from the perspective of assessing learning creativity. The data in this research shows that student creativity, with an average score of 4.46, is in the good category. In

random interviews, students also confirmed that they were very motivated and enthusiastic in understanding nutrition and food material. Motivation is the indicator with the highest average score, namely 4.95 or in a category that is almost close to very good. However, it cannot be denied from the findings that improvements and increases in students' creativity scores are still needed in each indicator so that they get a very good category.

From the research data presented, it is clear that cartoon animation media, with the help of artificial intelligence, can encourage a significant increase in student learning creativity in nutrition and food material, with an average rating of 4.46 or in the Good category. The data also shows that if learning is carried out appropriately and directed, it will have a good impact (Bahrudin & Yogihati, 2022; Boulianne & Theocharis, 2020). In this research, of course, if you look more deeply, it does not show maximum improvement or the very good category, where the new category is at the good category stage; this is a challenge in itself to familiarize students with interesting learning media so that all aspects of student creativity indicators can be maximized. This research will provide a detailed description of each indirect indicator of student creativity in nutrition and food learning after using a cartoon media learning model assisted by AI.

#### *Analysis of student creativity through Group Investigation indicators*

Student creativity in terms of group investigation indicators is creativity shown by students in solving or finding a new understanding in group analysis. This indicator consists of 4 questions to measure the level of student creativity. The student creativity scores for this indicator can be seen in Table 4.

**Table 4.** Student Creativity Scores with Group Investigation Indicators

Class	Average Value of Each Indicator	Category	Average value	Category
VA	3,5	Pretty Good		
VB	4,32	Good	4,44	Good
VC	4,56	Good		

This research clearly provides information as in table 4 which shows how the average student creativity score is 4.44, namely in the Good category. The good category also shows how AI-assisted cartoon media contributes to increasing student learning creativity. Creativity in the indicator group indicators shows quite good data, where of the three classes, there are two classes that got an average score in the good category, namely class VB (4.32) and also class VC (4.56), while for class VA (3.5) has a pretty good creativity score, of course, this is information that improvements are still needed in both the media used and the learning process so that the group investigation indicators can be better and maximized. Work with group investigations is able to encourage students to make new understandings of the information provided (Leak *et al.*, 2017; Schmidt, 2012), students in the process make efforts to solve a problem together and make a complete conclusion.

The research was also strengthened by data obtained from interviews with students, where the lecturer asked the students to pay attention to AI-assisted cartoon media, and the students tried to examine the meaning of the images by connecting them to everyday life. Students try to formulate the existing problems together and provide appropriate

conclusions. The ability to discuss problems in solving problems can encourage students to be more able to analyze problems logically and systematically (Sezen & B, 2012; Sungur *et al.*, 2006). Logical and systematic thinking in groups can help students indirectly increase their creativity.

#### *Analysis of student creativity through Pre-Knowledge indicators*

Researchers' findings regarding the ability of AI-assisted cartoon animation media for Pre-Knowledge indicators also show a positive impact on student creativity. Many students can find out what problems will be asked about nutrition and food and also the solutions, as well as what attitudes should be taken. The average value of student creativity for the Pre-knowledge indicator in Table 5.

**Table 5.** Student Creativity Scores with Pre-Knowledge Indicators

<b>Class</b>	<b>Average Value of Each Indicator</b>	<b>Category</b>	<b>Average value</b>	<b>Category</b>
VA	4,06	Good		
VB	4,12	Good	4,13	Good
VC	4,15	Good		

Student creativity in the Pre-Knowledge Indicators which can be seen in Table 5, clearly gives an indication that there is a good increase in student learning creativity where the average value of creativity in this indicator is actually 4.13 or in the Good category. The ability of students to understand the answers and questions before the test is carried out can have a significant impact on students in completing or understanding knowledge (Chin & Chia, 2004; Kritt, 2018). The ability of students to be able to know questions and answers like this is called creativity for the Pre-Knowledge indicator. The initial knowledge that students have can be obtained from the surrounding environment or previous events, so that when nutrition and food material is provided using AI-based cartoon animation media, they can combine old knowledge with new conditions of knowledge, resulting in a more complete understanding.

If we look at the creativity abilities produced, it is clear that the three classes, namely the VA, VB and VC classes, have an average score in the good category, where the VA class has an average creativity score of 4.06 in the Good category, then the VB class has an average of 4.12 in the Good category and also what happened in the VC class which had an average value of 4.15 in the Good category. This data clearly illustrates that students' creative abilities after the image media were provided were able to improve student's learning creativity in nutrition and food science courses. The results of interviews with several students, consisting of 5 students for each class who were taken randomly, strengthen the information that their abilities are greatly influenced by the environmental conditions they have experienced and also the knowledge that has been conveyed in nutrition and food courses. Prior knowledge is able to encourage students to more easily predict what will be conveyed and the answers given (Lovat, 2023; Patall *et al.*, 2017). Students' ability to predict questions and answers is a skill or creativity that must be possessed and maintained so that the process of exploring and understanding nutrition and food learning will be better.

*Analysis of student creativity through Cultural Influences and Value indicators*

Culture clearly influences people's lifestyles and of course it is influenced by the values or norms that apply in the community environment, there will be differences. This research illustrates how creativity with indicators of cultural influence and values is very important for the learning process, especially in mastering nutrition and food material. This research obtained data that student creativity in this indicator also experienced improvements in quality, although it still needs to be increased to the maximum. The data on the Cultural Influence and Values Indicators can be seen in Table 6.

**Table 6.** Student Creativity Scores with Cultural Influence and Value Indicators

Class	Average Value of Each Indicator	Category	Average value	Category
VA	4,17	Good		
VB	4,57	Good	4,70	Good
VC	4,83	Good		

Research data for the cultural influence and value indicators provide an illustration that creativity is in the good category with an average value of 4.70. The ability of AI-assisted cartoon animation media is able to enter the stages of life behavior in society and become part of culture. The impact of values and culture will encourage a person to understand knowledge and also determine attitudes. Lifestyle habits in society will greatly influence the knowledge acquired (Eagles & Demare, 1999; Pe'er *et al.*, 2007). Research shows that of the 3 classes, all classes have a good average. Basically, a person's ability to understand knowledge will greatly depend on his knowledge of values and culture (Craft, 2003; Zhang & Zhang, 2018).

Creativity abilities have increased based on cultural influence and value indicators because culture is usually inherent in each student regarding what is permissible. Students must adapt the information to their habits to form better values and culture, especially in nutrition and food patterns. Students also underwent an interview process where there were 15 students, with each student consisting of 5 people in the VA semester, 5 people in the 5B semester and five people in the VC semester who gave the same conclusion that habits and lifestyles in the community must be maintained and made into better so that a better and better quality of life in society is formed.

*Analysis of student creativity through Motivation indicators*

Motivation is a part that is always important to study and observe. Many researchers believe that success is actually determined by how motivated a person is towards their life goals (Hapke *et al.*, 2020; Zb *et al.*, 2021). A person's abilities usually always increase in terms of their motivation or life goals. This research places motivation as part of an indirect indicator of creativity which of course has an important role in student learning creativity. Students will be motivated if there is a stimulus that arises from external circumstances that can encourage students to take more actions (Kong, 2021; Miller *et al.*, 1988). Cartoon animation media assisted by AI provides encouragement or motivation for students to be better. The creativity value for student motivation indicators can be seen in Table 7.

**Table 7.** Student Creativity Scores with Motivation Indicators

Class	Average Value of Each Indicator	Category	Average value	Category
VA	3,62	Good	4,91	Good
VB	4,82	Good		
VC	5	Very Good		

Table 7 shows how student creativity is viewed in terms of motivation indicators, after the nutrition and food lecture process was carried out using cartoon media based on AI. Research data shows that there is one class, namely the VC class, which gets the maximum creativity criteria with an average score of 5, namely the very Good criteria, while the VA class gets an average creativity score of 4.62 and the VB class gets an average score of around 4.82 where both classes, VA and VB, received the Good category. Of course, improvements are still needed for the other two categories so that they are more optimal or perfect in the very good version category.

Cartoon animation learning media assisted by AI has been proven to be able to increase student creativity in terms of motivation indicators. The data shows that the average value of creativity on this indicator for the three classes is 4.91 and this is the highest value of the creativity indicator compared to the other 4 indicators. Card animation media is able to encourage students to go further and participate in lectures (Akamca et al., 2009; Arikan & Ulas Taraf, 2010), one of which is on the phenomenon of nutrition and food, all of them are encouraged from within themselves to know the benefits of nutrition and food for themselves and the surrounding community. The condition of the students was seen from the results of interviews conducted with 15 children, where each class was represented by 5 people randomly who said that cartoon animation media was very interesting and fun so that it was able to make lectures comfortable and in line with the reality in the field, both regarding the psychological impact of a healthy lifestyle and the impact negative that arises.

#### *Analysis of student creativity through Self-Esteem indicators*

Learning using cartoon animation media assisted by artificial intelligence also has an impact on student creativity in terms of self-esteem indicators, where in this category the average value of student creativity is actually 3.95 in the pretty good category. The complete data can be seen in Table 8.

**Table 8.** Student Creativity Scores with Self -Esteem Indicators

Class	Average Value of Each Indicator	Category	Average value	Category
VA	3,73	Pretty Good	3,95	Pretty Good
VB	4,04	Good		
VC	3,87	Pretty Good		

Table 8 provides information on how cartoon animation media assisted by artificial intelligence has had quite a good impact. However, when compared with the other 4 indicators, this indicator is the lowest and still requires further investigation. The self-esteem indicator is a student's own view, whether it comes from his feelings and thoughts regarding the benefits and role of nutrition and food courses in his personal life.

Understanding that comes from the student's personal self sometimes takes place absolutely as an answer to the truth without having to look at and analyze further the impact that arises (Hayes, 2015; Newhouse, 1990). The feelings you have about lifestyle views in nutrition and food courses are much easier to do than lifestyle management based on established principles and theories.

The research data shows that from the 3 classes that were conducted as research subjects, data was obtained that there were 2 classes that had an average score in the good quality category, namely class VA with an average score of 3.73 and VC with an average score of 3.87 while the VB class got a creativity score in the good category with an average score of 4.04 which is also almost close to the good creative category. Research on this indicator must of course be carried out further because the views that arise from students' personalities, or students' beliefs, must be observed and researched more deeply. From the results of interviews conducted by researchers with 15 students consisting of 5 students in each class who were taken randomly after the nutrition and food course was carried out, information was obtained that students are sometimes encouraged to do something they are used to doing, so changing their lifestyle is sometimes difficult. and contrary to existing theory, of course further analysis still needs to be carried out to obtain more valid information. Basically, in this research, students' creativity scores are quite good on this indicator and of course there are still many observational variables that must be investigated and considered.

## **CONCLUSION**

Learning creativity is one of the most important parts that must be improved and possessed by students, especially biology students in nutrition and food subjects. This research provides information that cartoon animation media assisted by Artificial Intelligence has been proven to be able to influence student learning creativity, especially in the indirect aspect of creativity. The results of student creativity from the research results show an average of 4.46 in the good category, where in detail, each indicator, such as Group Investigation, has an average value of 4.44 in the good category, Pre-Knowledge Indicators with an average value of 4.13 with the good category, then the Cultural Influences and values indicator with an average value of 4.83 in the Good category, the motivation indicator with an average value of 4.95 in the good category and the Self-esteem indicator with an average value of 3.87 in the Pretty category good. This research also provides information that the indicator with the highest creativity value is the motivation indicator, while the lowest is the self-esteem indicator, which, of course, still requires deeper analysis and study. In this research, the researcher used an AI application that can be used to create animated media, and the researcher suggests that other researchers focus on the AI application used so that it can provide more specific results. This research clearly provides evidence that cartoon animation media can have a good impact on students' learning creativity, especially biology students, especially in nutrition and food courses.

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