

# Development of Interactive Food Web Learning Media to Improve Mastery of Science Concepts and Student Creativity

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**Abstract:** The lack of use of technology-based learning media and low learning outcomes in mastery of science and science concepts and student creativity are problems at SD Negeri Kandangan 02 and Kandangan 04. The research aims to determine the feasibility and effectiveness of interactive learning media articulate storyline food web material to improve mastery of science and technology concepts and student creativity. The research method applied is the Define, Design, Development and Dissemination, development model with data collection techniques through observation, interviews, questionnaires, tests and documentation. The validation results for the media aspect 97.4%, material 97.6%, and language 98.2%, which stated that the media was very suitable for learning. Increasing mastery of science concepts in the experimental class obtained an average difference of 39.8 and an N-Gain of 0.76 with very effective criteria. Meanwhile, increasing mastery of science concepts in the control class received an average difference of 26 and an N-Gain of 0.52 with less effective criteria. Increasing student creativity in the experimental class obtained an average difference of 37.5 and an N-Gain of 0.59 with quite effective criteria. This research concludes that learning media is suitable and effective in increasing students' mastery of science concepts and creativity.

**Keywords:** Concept Mastery; Creativity, Food Webs; Interactive Media; IPAS.

## Introduction

Natural and Social Sciences (IPAS) learning is closely related to concept mastery. Through developing concept mastery students can receive information more quickly and systematically Jannah et al., (2023); Yuliatun et al., (2023) Stated that mastery is a level of ability where students are required to understand the subject matter presented and be able to utilize it without having to connect it with other things. Mastery of concepts in the context of science and science is the student's ability to understand the relationship between concepts so that they can be applied in problem-solving. Mastery of concepts is essential for students in the science and science learning process because learning focuses on students in the independent curriculum. Hence,

mastering concepts becomes the primary provision in obtaining information.

In the independent curriculum, teachers are required to develop learning creatively and innovatively. Carrying out innovation in education is not as easy as turning the palm of your hand, but it requires a person's tenacity and high level of creativity (Alimuddin, 2023; Barlian et al., 2023; Mulder et al., 2023). The aim of implementing the independent curriculum: Firstly, ensure that schools and regional governments have the authority to manage education according to the conditions of their respective regions. Second, forming human resources (HR) of superior quality and highly competitive. Third, prepare the nation to face the global challenges of the era of revolution 4.0. Fourth, strengthen character education through the Pancasila Student Profile. Fifth, it is a new

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curriculum that aligns with the demands of 21st-century education. Sixth, improve the quality of education in Indonesia as a whole (Andari, 2022; Angga et al., 2022; Pioke et al., 2023). As a teacher, you must have high creativity and be able to create various innovations in the field of education. Proving innovation in education can be done with small things first, namely being able to sort and generate learning media that suits students' needs when learning to realize the goals of an independent curriculum. Choosing the right learning media is one way to innovate and be creative in education. (Kusumadewi et al., 2023; Widodo et al., 2023). Nurwidiyanti & Sari (2022) They believe that learning media is a means, intermediary, tool, or connector used to convey messages and ideas that arouse students' feelings, thoughts, attention, and interest in participating in learning.

Food webs are one of the social science materials for grade V elementary school, contained in the social science learning book for grade V, Chapter 2, Harmony in Ecosystems, on topic A, eating and being eaten. Food web material is included in the learning outcomes. Students investigate how the interdependent relationship between biotic-abiotic components can influence the stability of an ecosystem in the surrounding environment. (Agustin et al., 2022; Pradipta et al., 2022; Utari et al., 2022). The learning objectives to be achieved in this lesson are that students can describe the relationships between living things related to food in the form of a food chain, students can identify the role of living things in the food chain, and students can describe the relationships of creatures in the food web. in larger food chains, and students can create dioramas of food webs in a food chain (Istiyasiwi et al., 2021; Prasetyo et al., 2023; Syarif et al., 2022).

IPAS can help students grow their curiosity about phenomena that occur around them. This curiosity can trigger students to understand how the universe works and interacts with human life. The basic principles of scientific methodology in science and science learning will train a scientific attitude (high curiosity, critical, analytical thinking skills and the ability to draw the correct conclusions), giving students wisdom (Agustina et al., 2022; Purba et al., 2023; Safitri et al., 2023). Mastery can also help students increase their creativity. Combined with food web material, students can express their creations and mastery. In line with the research conducted Ratih & Yanuartuti (2021) that creativity is a necessity in improving the quality of education and developing students' creative thinking abilities is very important for the educational revolution.

Based on the results of observations and problem analysis carried out by researchers at State Elementary School Kandangan 04, State Elementary School Kandangan 03, and State Elementary School Kandangan

02, it was found that teachers at State Elementary School Kandangan 04 and State Elementary School Kandangan 02 had not used interactive learning media. And the Problem-Based Learning model to the maximum. Teachers use learning media in the form of teacher books and student books provided by the government. In the learning process, teachers also tend to apply teacher-centred learning. Teacher-centred learning will negatively impact students, who will only pay attention to the teacher and be less active in education. This type of learning is less effective because the learning resources only come from teacher explanations and book material. This results in students not being optimal in exploring their knowledge, which results in low mastery of concepts and student creativity.

Students mastery of science and science concepts and creativity in science and science lesson content in grade V of SD Negeri Kandangan 02 is relatively low. Mastery of science and science concepts, as seen from the results of daily tests in the cognitive domain of students, shows that there are still many students' scores below the KKM (Minimum Completeness Criteria), which has been set at 70. Of the 28 students, 18 (64.29%) have not met the KKM, and 10 (35.71%) have completed the KKM. A similar thing was also found in students' creativity, which was seen in psychomotor scores, and many students still scored below the KKM. Of the 28 students, 15 (53.57%) had not met the KKM, and 13 (46.43%) had completed the KKM. This description shows the lack of maximum mastery of science and science concepts and students' creativity in science and science learning, even though teachers can develop mastery of science and science concepts and students' creativity in science and science learning food web material.

The low mastery of science and science concepts and students' creativity in solving the problems need to be resolved due to the lack of effective learning and inappropriate use of learning media. Science learning is included in the lessons that require attention and in the studies that will be tested in grade V. Apart from that, Science and Technology are subjects that can help students develop their creative thinking skills. So, creating interactive learning media and using appropriate learning models is a solution to increase students' mastery of science and technology concepts and creativity.

This research aims to develop interactive learning media that articulates the storyline of food web material, tests the suitability of the media, and pushes the effectiveness of the media in improving students' mastery of science and technology concepts and creativity. The benefit of this research is that it provides learning media that is appropriate and effective for use in the learning process to help improve students' mastery of science concepts and creativity.

## Method

Development research uses a 4D development model. 4D development model developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel. Mulyaningsih & Saraswati, (2017) stated that the research and development steps are abbreviated as 4D, which stands for Define, Design, Development and Dissemination. This model was chosen because the implementation stages are divided in detail and systematically. The research began with a needs analysis, then media creation, and continued with validation by experts and implementation at SD Negeri Kandangan 02. The curriculum analysis was adapted to the independent curriculum. The learning developed is material on food chains and food webs in the science and science lesson content for class V elementary school. The flow of research stages is shown in Figure 1.

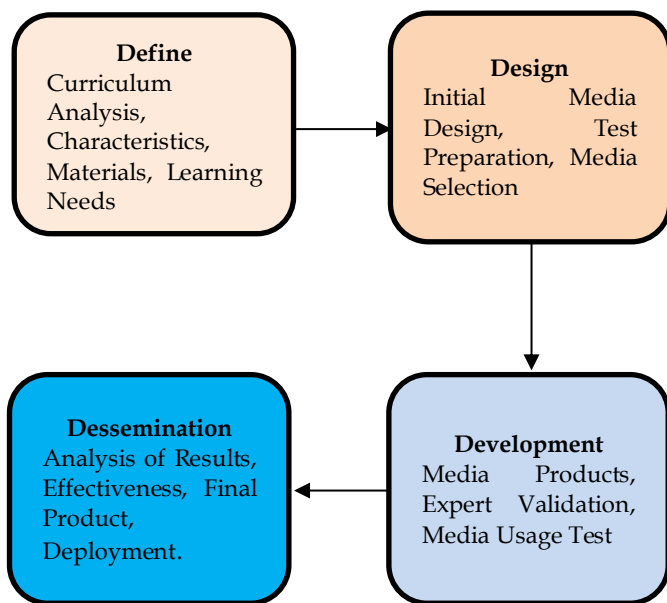


Figure 1. Flow of Implementation of Research Stages

Research data collection regarding the development of interactive learning media articulate storyline food web material was carried out by direct observation in grade V State Elementary School 02. Based on the results of observations, it showed low mastery of science and science concepts and student creativity, lack of development of learning models and innovation in the use of learning media. The research subjects comprised 28 students of grade V State Elementary School Kandangan 02 as the experimental class and 21 students of grade V State Elementary School Kandangan 04 as the control class. Data analysis techniques use questionnaire instruments to determine media use results and assess media suitability, test instruments to measure mastery of science and science concepts and observation instruments to measure student creativity.

## Result and Discussion

### Result

The development research that has been carried out has resulted in a product in the form of interactive learning media that articulates storyline material on food webs in science course content. Learning media was developed by focusing on food web material in class V of SD Negeri Kandangan 02, Semarang Regency. The research results examine the characteristics of learning media, the suitability of learning media, and increasing students' mastery of science and social concepts and creativity. Next, it is explained according to the research problem formulation.

### Characteristics of Learning Media

This research results in an interactive learning media product with articulate storyline food web material created using Articulate Storyline 3 and Canva software. Media designed using Canva to create animations and product designs. Then, Articulate Storyline 3 adds interactive features to the press. The start button to enter the initial menu, and the about button contains several essential things about the media such as instructions for use, learning outcomes, learning objectives, and developer profile. The initial display is shown in Figure 2.



Figure 2. Initial View

The display of the interactive learning media menu, articulate storyline, and food web material contains the presentation of the Let's Answer menu icon, which has stimulus questions. The Let's Observe menu icon has learning videos; the Let's Make menu icon contains Student Worksheets (LKPD); the Let's Play menu icon contains a drag-and-drop game; and the Let's Try menu icon has evaluation questions. The menu display is shown in Figure 3.

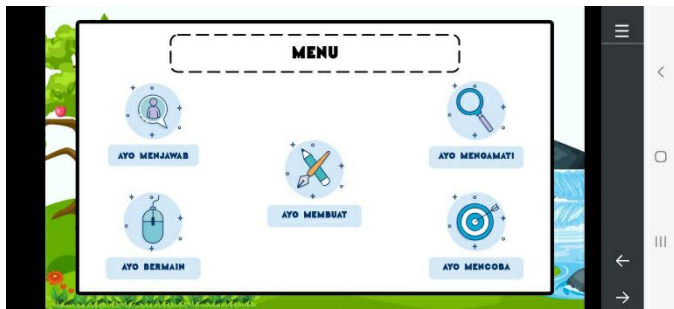


Figure 3. Menu display



Figure 6. Let's Create

The Let's Answer display, interactive learning media, articulate storyline, and food web material contain the start page, answer, start and return buttons to the menu, stimulus questions, problem orientation, and supporting images. The let's answer display is shown in Figure 4.

The Let's Play display, interactive learning media, articulate storyline, and food web material contain the Let's Play home page, start and return buttons to the menu, commands to drag and drop games, and images of drag and drop game components. The Let's Play display is shown in Figure 7.



Figure 4. Let's Answer



Figure 7. Let's Play

Let's observe interactive learning media articulate storyline food web material containing the start page, the start button, and return to the menu and animated video learning material. The let's observed display is shown in Figure 5.

The display, let's try, interactive learning media, articulate storyline, food web material, contains the start page, let's try, the start button and return to the menu, multiple choice evaluation questions to measure students' mastery of science and science concepts, and the final score obtained by students. The Let's Try display is shown in Figure 8.

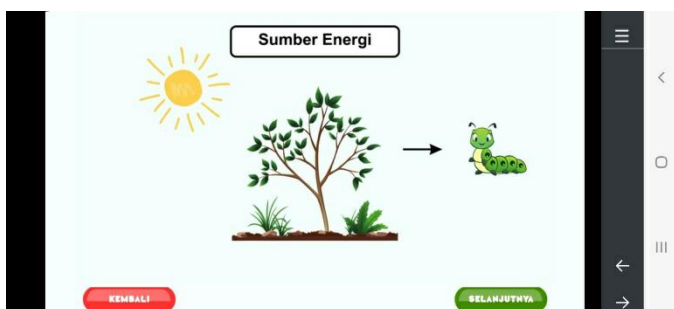


Figure 5. Let's Observe



Figure 8. Let's Try

The display, Lets Create interactive learning media, articulate storyline, food web material, contains the start page, make it, start button and return to the menu, tools, materials, and activity steps for working on the students worksheets, as well as conclusions. The students worksheets contains instructions for making a food web diorama, which can be used to measure student creativity. The Let's Create display is shown in Figure 6.

The media presented has innovation and development characteristics that are displayed in certain parts. First, the interactive learning media material articulates the storyline, food web material, science and science lesson content, and food web material for class V elementary school. Second, preparing interactive

learning media components, articulate storyline, and food web material was created using Canva as a web design to make it easier to create material and animations for learning media. Third, the press presents stimuli, learning videos, games, student worksheets and evaluation questions. Fourth, the media flow is designed to follow problem-based learning syntax to make it easier for teachers to guide learning and students to understand the material. Fifth, the videos presented contain teaching materials, examples, and animations relevant to learning activities. Sixth, the interactive learning media display, articulate storyline, and food web material are created through an articulate storyline designed and then exported into an easy-to-use application. Seventh, in the media, there is a stimulus for developing skills in mastering science and science concepts and student creativity. According to Aida et al., (2022); Asani et al., (2023); Setiadi et al., (2021) Media development needs to have characteristics so that the media can present learning material well.

*Feasibility of Learning Media*

The feasibility of interactive learning media articulate storyline food web material carried out several tests to assess the suitability of the product (Ulfaeni, 2017). The feasibility of interactive learning media articulate storyline food web material includes expert validation on media, material and language aspects, then a small-scale feasibility test to try out the use of the media and find out opinions on media use. The media feasibility results by expert validators are displayed on Table 1.

**Table 1.** Media Feasibility Results

Validator	Media Aspect	Material Aspects	Language Aspects	Information
Validator 1	100%	100%	100%	Very Suitable
Validator 2	92%	90%	95%	Very Suitable
Validator 3	100%	100%	100%	Very Suitable
Validator 4	97%	98%	100%	Very Suitable
Validator 5	98%	100%	96%	Very Suitable

*Increasing Students' Mastery of Science and Social Concepts*

A large-scale trial was conducted by providing learning to 28 grade V students at State Elementary School Kandangan 02 as the experimental class and 21 grade V students at State Elementary School Kandangan 04 as the control class. Interactive learning media articulates the storyline of food web material used as learning media and learning resources in learning activities. Before using interactive learning media to articulate food web storyline material, students do a pretest first. The pretest was carried out in the experimental class and control class.

*Normality Test*

The normality test on the initial research data is used to see whether the large-scale pretest and posttest data are normal. So that normality can be determined, the researchers carried out the Kolmogorov-Smirnov normality test, which is shown in Table 2.

**Table 2.** Normality Test

Test	Std Deviation	Test Statistic	Sig 2 Tailed
Experimental Class	3.84	0.14	0.17
Control Class	3.84	0.17	0.07

In Table 3, it is shown that the significance value of the pre-test and post-test results is 0.170 and 0.078, respectively, and the significance value is more than 0.05. So the results of the large-scale pretest and posttest scores have a normal distribution of sig values, 0.170 and 0.078 > 0.05, so that the assumption of normality is met.

*Homogeneity Test*

The homogeneity test was carried out to determine whether there were similar variances in the pretest and posttest. If the data has equal variance, it can be assumed to be homogeneous. To discover these similarities, it is necessary to carry out Levene's homogeneity test with the help of SPSS software version 25. The results of the homogeneity test are shown in Table 3.

**Table 3.** Homogeneity Test

Test	Based on Mean	Based on Trimmed Mean	Sig
Experimental Class	0.55	0.42	0.51
Control Class	0.09	0.11	0.73

Based on the Homogeneity Test calculations, the results from the homogeneity test of the pretest and posttest values show that the sig values are 0.518 and 0.733, so the data is homogen.

*T Test*

Once it is known that the pretest and posttest value data are normally distributed and homogeneous. So, using the parametric t-test formula, namely the Paired Sample T-test with the help of SPSS software version 25. The data processing results in the Paired Sample T-test aim to determine the effectiveness of interactive learning media in terms of storyline regarding food webs. The T-Test results are shown in Table 4. Based on the results of the t test on the results of the pretest and posttest values, the sig value is 0.00 while the significance is 0.05.

**Table 4.** *T test*

Test	Mean	N	Sig
Experimental Class	Pretest 42.50	28	0.00
	Posttest 82.32		
Test	Pretest 49.05	21	0.00
	Posttest 75.48		

**Table 5.** N-Gain Test

Test	N	Minimum	Maximum	N-Gain	Std. Deviation
Experimental Class	28	0.54	0.90	0.76	0.11
Control Class	21	0.38	0.64	0.52	0.07

The experimental class N-Gain test results obtained an N-Gain score 0.76 with high criteria. The effectiveness interpretation obtained a score of 76.50 with very effective criteria. Meanwhile, the control class obtained an N-Gain score of 0.52 with moderate criteria. The effectiveness interpretation obtained a score of 52.32 with less effective criteria.

**Table 6.** *Student Creativity T Test*

Test	The number of students	Mean	Sig 2 Tailed	Information
Pretest	28	35.68	0.00	<i>Ho</i> rejected
Posttest	28	73.21		

In the T test results, the sig value obtained is  $0.00 < 0.05$ , indicating an increase, then the N-Gain test results are shown in Table 7. The experimental class N-Gain test

**Table 7.** *N-Gain Test*

Test	N	Minimum	Maximum	N-Gain	Std. Deviation
Experimental Class	28	0.33	0.84	0.59	0.13

*Discussion*

The product design is prepared according to data obtained through interviews with teachers and students needs. The media results developed are applications that can be accessed online or offline. The media uses bright and cheerful themes to attract students' attention. How to visualize material content can influence cognitive processes in critical thinking and independence in learning and influence learning outcomes (Adelia et al., 2023; Alika & Radia, 2021; Rusli, M., 2017). This influence can occur due to limited sensory memory capacity (related to how information is entered visually and audio) and the learner's working memory in processing information into meaningful knowledge. Characteristics of interactive learning media articulate storyline food web material are designed with the following features The following Characteristics of interactive learning media, articulate storyline, food web material designed to include science and science lesson content, food web material for class V elementary school, created using Canva as a web design to make it easier to

*N-Gain Test*

Normalized gain (N-Gain) was used in this study to measure pretest and posttest scores. Gain shows student learning outcomes have increased after using interactive learning media with food web material. The N-Gain calculation of pretest and posttest learning results can be seen in Table 5.

*Increasing Student Creativity*

Student creativity is measured through the results of students' worksheet in making food web dioramas. The results of the T test for student creativity are displayed in Table 6.

results obtained an N-Gain score of 0.59 with moderate criteria, the effectiveness interpretation obtained a score of 59.06 with moderately effective criteria.

create material and animations that will be used in learning media, presenting media stimulus, learning videos, games, student worksheets, and evaluation questions, the press is designed following problem-based learning syntax, the videos shown contain teaching material and examples as well as relevant animations, created through an articulate storyline that has been designed, then exported into an application, providing a stimulus for developing students' skills in mastering science concepts and creativity. Raihan et al. (2023) In his research, he found that media characteristics are an essential element underlying media design and components. Media characteristics are the main characteristics for displaying novelty and innovation in learning media development.

Based on the expert assessment, Validator 1 scored 100% on the media, 100% on material, and 100% on language aspects with very decent criteria. Validator 2 scored 92% on the media aspect, 90% on the material aspect, and 95% on the language aspect with very decent criteria. Validator 3 scored 100% on the media, 100% on

material, and 100% on language aspects with very proper criteria. Validator 4 scored 97% on the media aspect, 98% on the material aspect, and 100% on the language aspect with very decent criteria. Validator 5 scored 98% on the media, 100% on the material, and 96% on the language, with very proper criteria.

Through giving these scores, the five Validators gave very decent scores with an average of 97.4% for the media aspect, 97.6% for the material aspect, and 98.2% for the language aspect, so it can be concluded that interactive learning media articulates the storyline of the food web material. Very suitable for use in learning. Donna et al. (2021) Her research shows that learning media is appropriate if it meets material needs in achieving learning objectives. Interactive learning media articulate storyline food web material has been assessed by validators as meeting the material needs in the media. There are also learning innovations, games and evaluations that make the validator give a worthy assessment.

A large-scale trial was conducted by providing learning to 28 grade V students at State Elementary School Kandangan 02 as the experimental class and 21 grade V students at State Elementary School Kandangan 04 as the control class. Interactive learning media articulate storyline food web material as learning media and learning resources in learning activities. Students carry out a pretest before using interactive learning media, articulate storyline, and food web material. Teachers and researchers provide learning using interactive learning media with storyline material on food webs to support delivering the material. Media is broadcast using projectors and individual devices to make it easier for students to watch and use learning media (Gumilar et al., 2023; Silfiani et al., 2022). Students can pay attention to the teacher's explanation using the media that has been provided. Students in groups discuss and work on student worksheet. After completing the learning activities, students worked on posttest questions distributed to all grade V students at State Elementary School Kandangan 02. In contrast, grade V students at State Elementary School Kandangan 04, as the control class, were not given the use of media.

The normality test results obtained a Sig value of 0.170 in the experimental class and 0.078 in the control class  $> 0.05$ . If the Sig value  $>$  Significance value 0.05, then  $H_0$  is accepted. The importance of Sig are 0.170 and 0.078. So, based on the results of the Lilliefors test above, it shows that the data is normally distributed. Furthermore, in the homogeneity test, the results obtained from the homogeneity test of the pretest and posttest values were that the Sig values were 0.518 and 0.733, respectively.  $H_0$  is accepted if Sig  $> 0.05$ . So, based on the results of the homogeneity test that was carried

out, it was concluded that both data from the pretest and posttest scores are homogeneous.

The t-test results on the pretest and post-test values showed that the Sig value was 0.00 while the significance was 0.05. This shows that there is an increase in learning outcomes. So, the results of the t-test regarding the learning outcomes of class V students at SD Negeri Kandangan 02 and SD Negeri Kandangan 04, Semarang Regency, before and after using interactive learning media articulate storyline food web material that has been carried out and developed, there is a difference in the average pretest and posttest scores, which is The average student learning outcome score increased to 82.32 from the previous score of 42.50, an increase of 39.8%. Meanwhile, the control class, which did not use media, obtained an increase in score from 49 to 75.40, where the minimum completeness criterion used was 75.

Increased mastery of science and social concepts was measured using the N-Gain score by comparing the scores obtained in the experimental and control classes. Increasing mastery of science and social concepts in the practical class obtained an average difference of 39.8 and an N-Gain of 0.76 with high criteria, and the effectiveness interpretation received a score of 76.50 with very effective criteria. Meanwhile, increasing mastery of science and social concepts in the control class obtained an average difference of 26.4 and an N-Gain of 0.52 with moderate criteria, and the interpretation of effectiveness received a score of 52.35 with less effective criteria. The data description shows that the experimental class, which implemented interactive learning media with articulate storyline material on food webs, achieved increased learning outcomes in mastering higher science concepts with very effective criteria. The application of learning media is practical in increasing concept mastery through student learning outcomes. (Donna et al., 2021; Nurwidiyanti & Sari, 2022; Prasetyo et al., 2023). In line with applied research Ulfaeni (2017) Students' mastery of concepts can increase with the help of learning media, because the use of learning media makes students think and process information directly from the media they use.

Student creativity is measured through the results of work on student worksheet, which has been carried out to assess the increase in student creativity using observation instruments before and after implementing learning using interactive learning media, storyline, and food web material. (Makhrus et al., 2019; Prabandari et al., 2022; Widiyanti, 2021). Activities to measure student creativity through making food web dioramas according to the student worksheet that has been prepared. Making food web dioramas uses materials that have been prepared on learning instruments. In the process, students are required to express their creativity through

designing dioramas. During the making process, students are assessed through observation of 3 aspects, namely student creativity in presenting information on a food web diorama, student creativity in conveying ideas, and creativity in assembling and demonstrating the components that make up a food web, the results of the assessment are processed as statistical data to measure the increase in student creativity. In line with the research. Hidayah et al. (2023) Student creativity can be trained through motor activities that target spatial intelligence. In making a food web diorama, students are required to combine colours, arrange components and write roles where student creativity is necessary to show beauty, neatness and harmony in the food web diorama.

The Sig value obtained in the T-test results is  $0.00 < 0.05$ . This means there is an increase in student creativity, which is shown in the N-Gain test. The results of the N-Gain test on the pretest and posttest scores showed that the average difference in the experimental class was 37.5, with an N-Gain of 0.59 and medium criteria. In the effectiveness interpretation, the score was 59.06, with the requirements being quite effective. Based on the description of statistical data, the application of interactive learning media, articulate storyline, and food web material is considered effective in increasing student creativity by up to 37%. In line with research carried out by (Darmawan, 2014; Nurmala et al., 2021; Ratih & Yanuartuti, 2021) regarding increasing creativity through the use of effective learning media applied to learning in elementary schools.

## Conclusion

Characteristics of interactive learning media articulate storyline, the food web material is designed to include science and social lessons, food web material for class V elementary school, created using Canva as a web design to make it easier to create material and animations that will be used in learning media, media presenting stimulus, learning videos, games, student worksheets, and evaluation questions, the press is designed following problem-based learning syntax, the videos shown contain teaching material and examples as well as relevant animations, created through an articulate storyline that has been designed, then exported into the application. The media assessment of the five Validators received a very decent score with an average of 97.4% in the media aspect, 97.6% in the material aspect, and 98.2% in the language aspect, so it can be concluded that the interactive learning media articulates the storyline of the food web material. Suitable for use in learning. The increase in mastery of the science and social concepts can be seen by comparing the N-Gain scores in the experimental class and the

control class. In the practical class, the average difference was 39.8, and the N-Gain was 0.76, with very effective criteria. Meanwhile, increasing mastery of science and social concepts in the control class obtained an average difference of 26 and an N-Gain of 0.52 with less effective criteria. Increasing student creativity in the experimental class received an average difference of 37.5 and an N-Gain of 0.59 with quite effective criteria. The experimental class that implemented interactive learning media with articulate storyline material on food webs achieved higher learning outcomes with very effective criteria. This research concludes that the interactive learning media that articulates the storyline of food web material is suitable for use and effective in increasing students' mastery of science and technology concepts and creativity.

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## Author Contributions

Conceptualization, L.M. and B.S.; methodology, J.S.; software, P.D.R.; validation, B.S., J.S. and P.D.R.; formal analysis, L.M.; investigation, L.M.; resources, L.M.; data curation, P.D.R.; writing—original draft preparation, L.M.; writing—review and editing, P.D.R.; visualization, P.D.R.; supervision, B.S.; project administration, L.M.; funding acquisition, L.M. All authors have read and agreed to the published version of the manuscript.

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## Conflicts of Interest

The authors declare no conflict of interest.

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