

# ICARE-Based Interactive Learning Media: Improving Digestive System Biology Learning Outcomes for Junior High School Students

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**Abstract:** This study aims to develop ICARE-based interactive learning media with the digestive system in humans as media content, which is used as a learning medium in the classroom as well as for students' independent learning, especially in class VIII SMP Muhammadiyah 16 Lubuk Pakam. The development of interactive learning media based on ICARE was obtained through observations from educators and students who stated that they needed learning media. Research development using the 4D method by Thiagarajan Has defined, designed, developed, and disseminated stages. The development process involves input from material experts, media experts, and instructional experts, as well as an acceptability test from students. The results showed that: (1) ICARE-based interactive learning media obtained a score of 4.42 for material experts, 4.69 for media experts, and 4.69 for instructional experts. In the field trial of interactive learning media, it obtained a mean value of 4.08 (high acceptability). Guidance and information aspects 4.07 (high), media material aspects 4.13 (high), evaluation aspects 4.10 (high), design aspects and media facilities 4.03 (high), and pedagogical aspects 4.09 (high), each of which indicates that the product being developed is very worth it. (2) The results of implementing ICARE-based interactive learning media were tested using the N-Gain Score to see the effectiveness of using media on learning outcomes. Research results show a 0.6 (moderate effectiveness). The conclusions of the ICARE-based interactive learning media research are feasible to use and effectively improve learning outcomes.

**Keywords:** interactive learning media; icare; biology; digestive system; natural science

## 1. INTRODUCTION

The learning process can be said to be good if the activity presents learning activities for students. The existence of interaction and connection between educators and students is expected to create a learning process that is optimally in accordance with the learning objectives. Someone is said to learn if there is a positive change both in terms of cognitive, affective, and psychomotor aspects. Efforts to develop the potential of students can be achieved by providing them with the opportunity to connect with components in the learning system. Dick & Carey [1] state that the components of the learning system are students, instructors or educators, teaching materials, and the learning environment, all of which have interactions in order to achieve learning goals.

Interactions in learning activities are further described by Arsyad [2], who views that the interactions that occur during the learning process are influenced by the environment, which includes students, educators, librarians, school principals, learning materials (books, modules, leaflets, magazines, video or audio recordings, and the like), and various learning resources and facilities (overhead projectors, audio and video tape recorders, radio, television, computers, libraries, laboratories, learning resource centers, etc.).

In the biology study results for the odd semester daily exams for the 2021–2022 academic year, the average score was 48.69 from KKM 65. Meanwhile, if you look further at the percentage of students who have completed the KKM, only 8 out of 23 students have passed the KKM, or 34.78%, while in the other

class, VIII, the learning completeness was only 3.2%. According to class VIII biology educators, the learning process is constrained by the available learning media. Biology educators at SMP Muhammadiyah 16 Lubuk Pakam still use books, pictures, and LKPD as teaching aids in their classes. In addition, anatomical models and pictures are an additional source of learning when explaining material about the digestive system. Classical problems such as a lack of interest in student learning and the fact that the available learning media have not been able to attract the focus of student learning are also problems that exist in SMP Muhammadiyah 16 Lubuk Pakam.

Based on the results of research on the use of learning media in Biology lessons conducted by Oktarini, Jamaluddin, and Bachtiar [3], it was stated that the use of instructional media plays a role in helping students understand the material. The animation media used by the team of 12 researchers is claimed to be able to improve student learning outcomes compared to only using picture media in biology lessons.

The ICARE learning model is the cornerstone in developing interactive learning media because this model is from the researcher's point of view and provides learning concepts whose problem solving can be linked to problems related to everyday life, so that it is expected to be relevant to students' initial knowledge. The developed learning media are expected to make it easier for students to understand both concepts and theories, so that students are also more proactive in learning and learning objectives can be achieved by increasing learning outcomes.

## 1.1 The Nature of Learning Biology

Learning in Sardiman [4] is defined broadly as a psychophysical activity leading to full personal development. Then, in a narrow sense, learning is intended as an effort to master scientific material, which is part of the activity towards the formation of a complete personality. Furthermore, Sukmadinata [5] views learning as always related to changes in the learner, whether they are planned or not. Another thing that is always related to learning is experience, either in the form of interaction with other people or their environment.

Then Rusman [6] has the view that learning is a system. The implementation of learning is an integration of various components that have their own functions, with the intention that learning can run as it should. Reigeluth & Merrill [7] classify learning variables into three categories: learning conditions, learning methods, and learning outcomes. Learning conditions are the first point explained by Reigeluth, showing that learning conditions are the beginning of how learning will be presented, starting from the objectives and characteristics of learning materials, constraints, and students. By understanding how the learning conditions are, learning methods and learning outcomes can be formulated. If learning is seen as a process from initial activities to learning outcomes, a learning strategy is needed in which methods, structures, and management are formulated to achieve effective learning outcomes.

Biology is part of the Natural Sciences (IPA), which deals with how to systematically find out about nature so that it is not only the mastery of a collection of knowledge in the form of facts, concepts, or principles but also a process of discovery. Science education is expected to be a vehicle for students to learn about themselves and the environment, as well as prospects for further development in applying it in everyday life. The learning process emphasizes giving direct experience to develop competencies in order to explore and understand the natural surroundings scientifically. Science education is directed toward inquiry and action so that it can help students gain a deeper understanding of the natural world around them.

Anjarsari [8] stated that the government mandated in the 2013 curriculum that SMP Science subjects be developed as integrative science subjects, application-oriented, developing thinking skills, learning abilities, curiosity, and caring attitudes and responsibility for the natural environment. The general learning objectives are to increase knowledge, skills, and attitudes in a balanced way.

The digestive system in humans is one of the subjects studied in class VIII IPA. The digestive system is the body's mechanism that processes food essences in the form of nutrients found in food and drinks consumed by humans. The digestive system in humans starts with the mouth, esophagus, stomach, small intestine, and large intestine. The digestive system in humans also discusses the nutrients the body needs as well as problems (disorders) in the digestive system.

## 1.2 ICARE Learning Model

The link between learning strategies and learning models Hadratullah [9] explains that learning strategies are activity plans in the form of steps in learning and the use of various facilities and infrastructure to achieve a goal. While the

learning model is part of the learning strategy, which is a sequence of activities in classroom learning,

The ICARE learning model was developed based on a simple pedagogical model [10]. The pedagogical model is a way of learning done by looking at the learning process, management, and interactions between educators and students. ICARE includes five key elements of the learning experience that are organized into several sections, namely: Introduction, connection, application, reflection, and extension.

Thus, it can be concluded that the ICARE learning strategy is to maximize student learning activities. The strategy that can be carried out is by planning learning activities in which there are plans of action, activities, utilization of resources, and how to collaborate everything in order to achieve learning goals.

## 1.3 The Nature of Learning Media

According to Arsyad [11], the media is defined as an intermediary or messenger. Meanwhile, Smaldino [12] states that media is the plural form of intermediary, which is a means of communication. With the media, the flow of information can be disseminated from the sender of the message to the recipient of the message. The use of media in learning is a must, because even with the lecture method, the media used is oral. Like Personal opinion [13], which states that the use of media as a learning tool has been around for a long time, even since humans carried out learning processes and activities.

Furthermore, when paired with learning, learning media is defined by Soenarto et al. [14] as all kinds of tools or equipment in any form that can be used by educators, teachers, instructors, or trainers to help and expedite the learning process.

Learning media, according to Arsyad [15], is a medium that carries a message in the form of information that has instructional purposes and contains teaching intent. Learning media include tools that are used physically to convey teaching material. The media used in learning is intended to make the learning process more effective and efficient.

Wibawanto [16] states that an interactive learning medium is a product of multidisciplinary knowledge, so if the maker of the medium only masters the creation and processing of material, graphics personnel are needed to work on this stage. To produce interactive learning media that are in accordance with procedures but also without forgetting the aesthetic element, educators must be not only proficient in operating applications but also include elements of artistic touch.

Learning media used in learning have a function as a tool for educators in the teaching and learning process. Arsyad [17] argues that one of the main functions of learning media is as a teaching aid, which also influences the climate, conditions, and learning environment that are arranged and created by educators. Smaldino [18] states that technology and media can play many roles in learning. If learning is centered on educators, then technology and media are used to support the presentation of subject matter. However, if learning is student-centered, students will play the role of the main users of the technology and media used.

## 1.4 ICARE-Based Interactive Learning Media

ICARE-based learning media are learning media developed using the principles of the ICARE learning model. The

developed ICARE-based interactive learning media includes five key elements of the learning experience, namely: Introduction, Connection Application, Reflection, and Extension.

Broadly speaking, learning media development activities consist of three major steps that must be passed, according to Sugiyono [19], who explains that developing learning media requires planning, production, and assessment activities. Furthermore, Reigeluth [20], in a learning paradigm that is centered on student learning activities, states that the main role of using technology in learning is to serve students, whereas with learning media, students play a more central role.

The use of the ICARE learning model in the development of interactive learning media aims to ensure that students have the opportunity to learn with media that are appropriate to the problem and the surrounding environment, as well as to provide

opportunities for students to apply what they have learned. As a learning resource developed to assist educators in learning in the classroom. ICARE-Based Learning Media is also anything that can support the learning process so as to provide positive changes. Learning media used in learning have a function as a tool for educators in the teaching and learning process.

One strategy that can be used by educators in learning science (biology) is an inquiry-based learning strategy. The inquiry-based learning strategy was then carried out based on the ICARE learning model. The ICARE learning model was developed departing from a simple pedagogical model, namely how learning is directed by stimulating students' focus on learning objectives, connecting to problems encountered in everyday life, how to apply them, measuring the achievement of learning objectives, and following up with follow-up activities so that students' learning activities are more optimized.

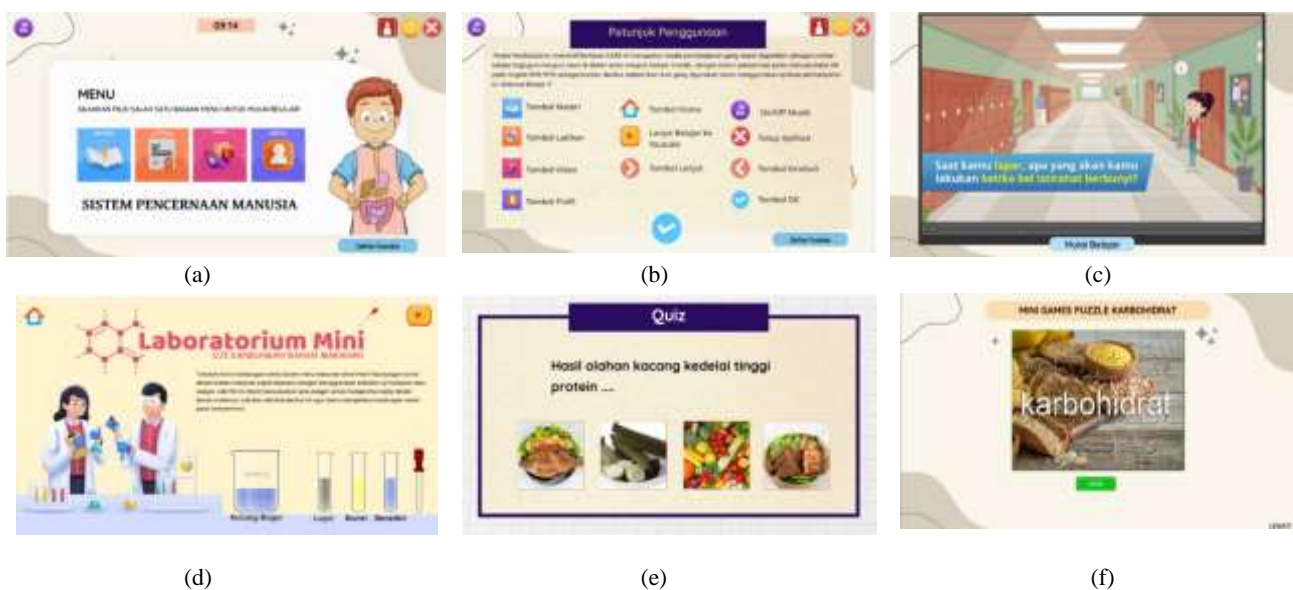


Figure 1. (a) Initial Menu Display; (b) Media Use Instructions; (c) Introduction Videos; (d) Mini Laboratory Display; (e) Display a short quiz; (f) Mini Games

The research problems are formulated as follows: (1) Is it appropriate to use ICARE-based interactive learning media in learning material on the human digestive system?; and (2) Can interactive learning media based on ICARE be effective in increasing learning outcomes in the subject of the human digestive system?

## 2. METHOD

The research model used is Research and Development or Research and Development (R&D). Sukmadinata [21] stated that the research and development (R&D) method is a strategy or research method that is powerful enough to improve practice.

Research and development of the Research and Development cycle, which consists of studying research findings related to the product to be developed, developing a product based on the findings, testing the product where the product will be used, and finally revising it to correct deficiencies found in the testing phase, The next stage is Research and development; this cycle is repeated until the trial results show that the product fulfills its purpose or is suitable for use.

This research will be carried out at SMP Muhammadiyah 16 Lubuk Pakam, Lubuk Pakam District, Deli Serdang Regency, for class VIII students in the Odd Semester for the 2022/2023 academic year.

The procedure and development design used in this research are research and development. In research and development methods, there are several types of models. The model used in the development of ICARE-based interactive learning media is a 4-D model. The 4-D (Four D) development model is a learning device development model. This model was developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel [22]. The 4D development model consists of 4 main stages, namely: Define, Design, develop, and Disseminate. This method and model were chosen because they aim to produce products in the form of interactive learning media. The products developed are then tested for feasibility, validity, and product trials to determine the extent to which ICARE-based interactive learning media products are appropriate for use in classroom learning. The research design used in this research is the 4-D model development research design (Four D Models), according to Thiagarajan. This includes four stages, namely the define, design, develop, and disseminate stages.

A feasibility analysis of ICARE-Based Interactive Learning Media was carried out to measure the feasibility of the ICARE-based interactive learning media that was developed. Data analysis was carried out based on expert validation questionnaires consisting of material experts, instructional design experts, media experts, and user (student) acceptability. Questionnaire data processing in this research and development is for calculating media validity with the percentage of answers.

Meanwhile, as a basis for decision-making to revise ICARE-based learning media products, the feasibility level criteria are used as written in Table 1 below:

**Table 1. Interpretation of multimedia eligibility**

No	Percentage of Achievement	Interpretation
1	1,00 – 2,49	Not Eligible
2	2,50 – 3,32	Less Feasible
3	3,33 – 4,16	Decent
4	4,17 – 5,00	Very Decent

ICARE-based interactive learning media is said to be suitable for use if it reaches a percentage of 75% or even close to 100%, while ICARE-based interactive learning media is said to be inappropriate if it has a percentage below 65%.

An analysis of the effectiveness of ICARE-based interactive learning media was carried out to measure the effectiveness of the developed interactive learning media. Data analysis was carried out based on student learning outcomes tests (pretest and posttest) using the N-gain score.

Data analysis in the form of pretest-posttest learning result data was carried out to find out the increase in learning outcomes, which was carried out using the N-gain score formula as follows (Sundayana, 2016):

$$N - \text{Gain Score} = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximum score} - \text{pretest score}}$$

After obtaining the results from the data managed using the formula above, these results are matched with the N-gain score criteria as shown in Table 2 below:

**Table 2 Criteria for N-Gain Score**

No	Criteria	Boundary
1	High	N-Gain score $\geq 0.7$
2	Moderate	$0.3 \leq \text{N-Gain score} \leq 0.7$
3	Low	N-Gain score $\leq 0.3$

(Sumber: Hake [23])

ICARE-based interactive learning media is said to be effective if the minimum N-Gain score is in the moderate category, or in other words, if there is a significant increase in learning outcomes between before and after the use of ICARE-based interactive learning media and the percentage of students who meet the criteria increases after using the media. ICARE-based interactive learning

Whereas ICARE-based interactive learning media is said to be ineffective if the N-Gain value has a low category, or in other words, there is no increase in learning outcomes, and the percentage of students who meet the criteria after using ICARE-based interactive learning media's learning outcomes

do not increase, decrease, or remain the same as before using ICARE-based interactive learning media.

### 3. RESULTS AND DISCUSSION

#### 3.1 RESULTS

The ICARE-based interactive learning media assessment results were validated for material experts, media experts, individual trials, small group trials, and limited field trials for all aspects of the assessment determined by the average score. The results of the assessment were then analyzed and determined whether or not it was appropriate to develop Scandura structure-based e-learning tools. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials, and field trials is shown in Table 3 below:

**Table 3. ICARE-based interactive learning media assessment results**

No	Categorization	Percentage of average score	Criteria
1.	Material Expert Validation	4,42	very feasible
2.	Media Expert Validation	4,69	very feasible
3.	Learning Design Expert Validation	4,69	very feasible
4.	Individual Trial	4,45	very feasible
5.	Small Group	4,20	very feasible
6.	Field Testing	4,08	very feasible
Rata-rata		4,42	very feasible

Feasibility ICARE-based interactive learning media learning tools show that the results of material expert validation, media expert validation, individual trials, and field trials show an average of 4.42 in the very feasible category, which means that the use of ICARE-based interactive learning media meets the needs of students, is well received by students, and can have a high pedagogical effect.

Measuring effectiveness is done by doing a pretest and a posttest. At the time of conducting the pretest, students were given ICARE-based interactive learning media before being given the posttest, while in the posttest phase, it was carried out after students had received the teaching and learning process using ICARE-based interactive learning media.

After obtaining the values in the pretest and posttest phases, the researcher then needs to calculate the difference between the two. The calculation of the difference in value is intended to show the level of effectiveness of using ICARE-based learning media in classroom learning, especially in science lessons on the digestive system in class VIII.

The N-Gain Score is used to see a comparison between the gain or achievement scores obtained by students and the highest gain or achievement scores that students might get. The scores obtained after the pretest and posttest are as follows:

**Table 4. Pretest and Posttest Test Results**



No	Prettest	Posttest	N-Gain Score	Criteria
1	47,5	80	0,6	Moderate
2	50	85	0,6	High
3	45	90	0,8	High
4	50	85	0,7	High
5	40	70	0,5	Moderate
6	57,5	87,5	0,7	High
7	62,5	92,5	0,8	High
8	45	85	0,7	High
9	50	75	0,5	Moderate
10	50	77,5	0,6	Moderate
11	25	60	0,5	Moderate
12	50	72,5	0,5	Moderate
13	52,5	72,5	0,4	Moderate
14	40	82,5	0,7	High
15	60	80	0,5	Moderate
16	55	80	0,6	Moderate
17	35	60	0,4	Moderate
18	35	80	0,7	High
19	32,5	72,5	0,6	Moderate
20	52,5	75	0,5	Moderate
21	57,5	85	0,6	Moderate
22	57,5	87,5	0,7	High
Total	1050	173,9	0,6	Moderate
Mean	47,7	78,9	0,6	Moderate
Value Result	"Medium" Category Effectiveness			

A total of nine students demonstrated effectiveness with "high" criteria, while 13 students had "moderate" criteria. Medium and high criteria theoretically mean that there is a significant increase in learning outcomes between pretest and posttest, which can also mean that the use of ICARE-based interactive learning media is effective in increasing students' cognitive or knowledge as assessed by an increase in learning outcomes. The average result is 0.6 in the moderate category. Thus, overall, the results obtained showed that the use of interactive learning media based on ICARE provided a significant increase in learning outcomes for students of SMP Muhammadiyah 16 Lubuk Pakam, class VIII.

### 3.2 DISCUSSION

Research and development on ICARE-based interactive learning media produces products in the form of learning media that can be used as learning resources for students. ICARE-based interactive learning media can be used as a source of learning in the learning process in class. The ICARE learning model was developed based on a simple pedagogical model [24]. The pedagogical model is a way of learning done by looking at the learning process, management, and interactions between educators and students. ICARE includes five key elements of the learning experience that are organized into several sections, namely: Introduction, connection, application, reflection, and extension. Based on this learning model, interactive learning media are designed and developed following the stages of learning.

The process of developing ICARE-based interactive learning media was developed using the development research method, namely research that aims to produce a particular product. Sukmadinata [25] states that the research and development (R&D) method is a strategy or research method that is powerful enough to improve practice. The product resulting from this research is interactive learning media as an alternative source

of learning. Educators and students are given flexibility in their use of the media as a learning resource or as a teaching aid.

Media as a teaching aid means that educators use interactive learning media based on ICARE, discussion, and direct question and answer in class. Meanwhile, the media as a source of learning for students is given the freedom to study whenever and from anywhere according to the learning time that students have. The development of interactive learning media based on ICARE on the subject of the digestive system in class VIII humans, went through an assessment process by several experts who were competent in their fields. Material about the digestive system in humans becomes content that is contained in the learning media developed to get a value of 4.42 with the criteria of "very feasible".

The use of ICARE-based interactive learning media in class VIII students with the subject of the digestive system in humans shows a positive influence on mastery of concepts and systems, and has a positive effect on learning outcomes. ICARE-based interactive learning media is used as a learning resource by educators in the classroom during science (Biology) lessons as well as a learning resource for students outside the classroom.

Hamalik [26] defines learning outcomes as changes in behavior in a person that can be observed and measured in the form of knowledge, attitudes, and skills. In an effort to improve learning outcomes, students are given a pretest to find out the extent of their understanding. Interactive learning media based on ICARE are then used in the teaching and learning process between educators and students. At this time, the researcher acts as an observer to determine whether the use of media is appropriate or not.

The posttest is given after the entire content or material in the media has been studied. 99 The N-gain (normalized gain) score is used to measure the effectiveness of using a particular approach or method in a study. By applying the pretest and posttest n-gain scores to measure whether there is an increase in knowledge and cognitive learning outcomes between before and after the use of ICARE-based interactive learning media in learning science (Biology).

The results of the n-gain score measurement get a mean score of 0.6 (medium effectiveness), thus the use of ICARE-based learning media is effective in improving learning outcomes. Based on some of the descriptions above, it can be concluded that the developed ICARE-based interactive learning media is suitable for use in the teaching and learning process in the classroom or as an independent learning medium for students, especially in Biology Science lessons on the material of the human digestive system. And in general, it is considered effective in improving student learning outcomes in an effort to achieve learning goals.

### 4. CONCLUSION

Based on the formulation of the problem, objectives, results, and discussion in the research on the development of ICARE-based interactive learning media on digestive system material in class VIII SMP Muhammadiyah 16 Lubuk Pakam, which has been described previously, several points can be concluded as follows:

1. Products in the form of ICARE-based interactive learning media have very feasible results when used in the learning process in the classroom. This is supported by several

validation processes involving material, media, and instructional experts, all of which are "very feasible" to use.

2. In the effectiveness test using the N-Gain Score, learning using ICARE-based interactive learning media shows an increase in learning outcomes before and after using learning media that was developed with a value of 0.6, or getting into the "moderate" category. Thus, it can be said that ICARE-based interactive learning media are effective for improving science learning for students.

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