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Development of an Active Learning-Based Biology KIT for Class XI MIA Students on Digestive System Material

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ABSTRACT

The digestive system is one of the materials in class XI MIA which requires students to be able to present a report on the results of the food test practicum. However, in Biology learning at MA Ihyaul Ulum this has not been realized. This is due to the unavailability of laboratories and supporting tools and materials for practicum, as well as the lack of innovation from teachers. When teaching Biology, teachers tend to use the lecture method so that students become less active in learning Biology. Therefore, a learning media was developed that can be used to conduct a food test practicum on digestive system material in the form of an Active Learning-Based Biology KIT. This study aims to develop and test the validity and practicality of the Biology KIT products developed. This research uses the 4-D development model which is simplified into 3-D. This research was conducted at MA Ihyaul Ulum Wedarijaksa Pati on 6 February 2023 to 6 March 2023 with the subject of Class XI MIA 1 which numbered 33 students. This study found that the Active Learning-Based Biology Learning KIT product developed in the category of highly valid with a percentage score of 95% based on the assessment of material experts and a score of 98% based on the assessment of media experts. In addition, the Active Learning-Based Biology Learning KIT product developed is also in the very practical category with a score of 96% based on teacher trials and 93% based on student trials.

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INTRODUCTION

One way that can be done to improve the quality of education is by innovation. Innovation in the world of education is important for teachers, because teachers have a role as educators, parents, friends and motivators for their students. One of the innovations that can be carried out by teachers is learning media innovation. A teacher should have skills in preparing learning media because learning media can be used by teachers as teaching materials so that students more easily accept and understand learning material (Nurrita, 2018). Learning media also functions to channel messages from teachers so that students' thoughts, attention, and learning motivation will be stimulated and have a good impact on learning activities that are directed and controlled (Yusufhadi Miarso, 2016). Learning media also assist teachers in teaching as a means to convey messages to students so that learning objectives are achieved and learning outcomes increase (Nurrita, 2018). In addition, the use of learning media can also be used as

a step for implementing Active Learning for students so that students can be more active during learning activities (Afifah, 2021).

Activities are the most important parts for an active learning. According to Paul D. Diedrich, active learning is divided into visual activities, moral activities, listening activities, writing activities, drawing activities, motor activities, mental activities, and emotional activities (Sadirman A.M., 2018). Based on observations when researchers carried out Field Professional Practices at MA Ihyaul Ulum, namely in August 2022, it was seen that the students' motor activities were low. This is evidenced by 65% of students being less active when invited to practice making cell replicas by PPL students. In addition, the low motor activity of students was also seen when students were invited to practice of diffusion and osmosis.

Based on observations made on November 9, 2022, it shows that learning Biology in class XI MA Ihyaul Ulum has not made maximum use of learning media. Teachers tend to teach by using makeshift media, such as using a blackboard. This was due to time constraints and the busyness of the Biology teacher who served as Deputy Public Relations Deputy MA Ihyaul Ulum. In addition, teachers also rarely do practicum due to the unavailability of practicum support tools and materials and the unavailability of laboratories. In fact, in the digestive system material KD 4.7 Biology to be precise, Class XI MIA students are expected to be able to present reports on the results of tests for nutrients contained in various types of food ingredients related to the energy needs of each individual as well as food processing technology and food safety.

Based on observations made when learning Biology, it can be seen that students' mental activities are low. This is evidenced by 90% of students being passive when asked questions, not daring to express opinions, and difficulties when invited to formulate and identify a problem. Based on the results of interviews with Biology subject teachers, information was obtained that students' emotional activities were also lacking. This is evidenced by students who are not focused and get bored easily when taking Biology lessons. In addition, based on the results of the daily assessment of the digestive system material for class XI MIA 1, an average value of 70.6 was obtained. This shows that students' ability to understand digestive system material is still lacking.

One of the learning media that can be offered to overcome these problems is the Biology-Based Active Learning Learning KIT. Integrated Instrument Component (KIT) is a learning medium that is packaged in a box containing practicum equipment, so that students can carry out practicum based on the theory they have learned (Nursari & Okimustava, 2019). While Active Learning is a term that denotes teaching and learning activities in which students are required to be actively involved in certain tasks (Amitya Kumara, 2004). The KIT media that will be developed in this study contains material tools for practicum accompanied by Active Learning-based Student Worksheets so that students can be more active and have practical experience.

KIT media helps students to be directly involved in practicum activities, so that students will be motivated to learn and have practicum experience. In addition, learning that takes place will be more memorable and create a pleasant atmosphere because all students can be directly involved in the learning process (Novembli M. S., 2015). KIT media can also be interpreted as a set of science testing tools designed and packaged in a container in the form of a unit box and equipped with instructions for use (Pakaya, 2015).

Learning Science, including biology, really needs teaching aids because in learning Science there are many abstract things that easily lead to misconceptions when only explained using theory or pictures. Teaching aids and KIT Biology Based Active Learning can improve students' affective and psychomotor abilities because students will learn concrete forms, through objects that can be seen, held, assembled, or modified in shape. The existence of teaching aids and KIT Biology-Based Active Learning in educational facilities is mandatory in every school, but in reality there are still many schools that do not have them

(Novi Ratna Dewi et al., 2021).

Based on the explanation of the problems above, it is necessary to develop Biology-Based Active Learning Learning KIT media so that students have practical experience and can be more active in learning Biology, especially in the digestive system material. Similar research on KIT development has been carried out by Yelly Jelita with the title "Development of KIT (Integrated Instrument Component) Guided Inquiry-Based Chemistry Practicum on Acid-Base Material." Yelly Yelita's research results show that KIT media can make it easier for students to understand the concept of acid-base material because this media makes it easier for students to find their own concepts. In addition, KIT media has also been proven to be able to improve student skills (Jelita et al., 2021).

METHOD

The research method used in this study is the R&D (Research and Development) method or development research. The development model used is 4D which follows the plot of Thiagarajan, Dorothy S. Semmel and Melvyn I. Semmel. The 4D development model consists of Define, Design, Develop, and Disseminate. However, this research is only limited to the Develop stage. The define stage is carried out with front end analysis activities, student analysis, concept analysis, task analysis and formulation of learning objectives. While the design stage is carried out by making a KIT box design along with the layout of tools and materials, making sticker designs and designing Student Worksheets. After the design stage is complete and the initial product is ready, then the product is validated by experts at the develop stage. After the product has been validated by experts and received ratings and suggestions, the product is then revised according to input from experts. After the product was revised, it was then tried out on teachers and students to obtain an assessment of the practicality of the Biology-Based Active Learning KIT product that was developed.

This development research was carried out at MA Ihyaul Ulum Wedarijaksa, Pati. The subject of this research was class XI MIA which consisted of 33 students. Data collection instruments in this study were carried out through observation, interviews, questionnaires, and documentation. The data collected from several types of instruments that were developed were then analyzed. The results of the material and media expert validator's assessment questionnaires were analyzed to become product validity data, while the teacher and student pilot test results were analyzed to become product practicality data. The ratings given were analyzed with the criteria for answer scores based on the Likert scale listed in table 1.

Table 1. Answer score criteria for validity and practicality analysis

No.	Evaluation	Category	score
1	SS	Strongly agree	5
2	S	Agree	4
3	CS	Simply agree	3
4	TS	Don't agree	2
5	STS	Strongly disagree	1

After the score is known, then determine the percentage value of product validity and practicality using the following formula:

$$\text{Percentage} = \frac{score\ obtained}{max\ score}$$

Percentage results can be converted into qualitative understanding based on the following Table 2.

Table 2. Criteria for evaluating product validity and practicality

No.	Interval	Category
1	0%-20%	Very invalid
2	21%-40%	Invalid
3	41%-60%	Less valid
4	61%-80%	Valid
5	81%-100%	Very Valid

RESULTS AND DISCUSSION

The result of this development research is the Biology-Based Active Learning Learning KIT. This Biology Based Active Learning Learning KIT product is equipped with a Student Worksheet which can be used as a guide in carrying out practicum activities. The Student Worksheet that has been developed also contains a QR code which can make it easier for students to carry out practicum activities.

The Student Worksheet and all the tools and materials provided in the KIT are packed in a plastic box. Plastic itself is an example of a polymer material that has a low density and can be used as a thermal and electrical insulator. Electrical and heat conductivity of materials plastic has low strength because all heat or electrical energy is transmitted from hot areas to cold areas or from areas of high electric potential to areas of low potential by means of atomic vibrations (Sucipta et al., 2017). This box made of plastic was chosen because it has the advantages of being light, strong, easy to shape, anti-rust, resistant to chemicals, has high electrical insulating properties, and is affordable (Mujiato, 2005). The KIT box is also given a sticker to make it more attractive and easy to identify. The sticker for the KIT box is printed on vinyl. This sticker with vinyl material has a glossy surface and has superior properties, namely it is highly resistant to water (Ariyetti et al., 2022).

All components available in the KIT can be categorized into tools and materials. Tools are objects that can be used repeatedly (Made Dian Andriani, 2022). While materials are anything that can be used for testing, calibration, or production on a limited scale (Rico Vendamawan, 2015). Included in the category of tools are test tubes, test tube racks, matches, Bunsen burners, test tube clamps, plastic cups, drip plates, toothpicks, pipettes and spoons. While those included in the material category are reagents (lugol, benedict, biuret), opaque paper, label paper, powdered egg whites, powdered soybeans, rice flour, powdered milk, cooking oil, granulated sugar, distilled water, and vitacimin.

The development of Biology-Based Active Learning Learning KIT media begins with the activity of making a Box design and the layout of tools and materials. Box KIT is designed with 3 main layers. The first layer is used for test tubes and drip plates, the second layer is for food ingredients (egg white powder, soybean powder, rice flour, powdered milk, cooking oil, granulated sugar, vitacimin), dropping pipettes, Student Worksheets, and frosted paper. While the third layer, for cooking oil, Bunsen, test tube rack, test tube clamp, aqua glass, toothpicks, label paper, matches, betadine, lugol, benedict, biuret. After making the product design, the researcher then started to compile layer prints as a place for tools and materials in the KIT box. The print on the KIT layer is made using Styrofoam and covered with white manila paper. This layer print was made with the aim that the tools and materials contained in the KIT do not move from place to place and are safe when taken anywhere. After all the layer prints have been made, they are then placed in the KIT box according to the initial layout plan. After all the layers have been placed in the box, then the tools and materials are placed in their respective places.

In addition to making a box design and its layout, the researcher also made a sticker design that would be affixed to the Biology-Based Active Learning Learning KIT. The sticker that will be attached to the front of the Integrated Instrument Component (KIT) box was designed using the latest version of the Canva application in 2023. Canva itself is an online design application that can be used to design presentation templates, resumes, posters, flyers, brochures, charts, infographics , banners, bookmarks, bulletins, and so on (Garris Pelangi, 2020). After the design is finished, the stickers are printed using vinyl type sticker paper with a size of 30 cm x 80 cm. The sticker designed by the researcher contains the IAIN Kudus logo, the Tadris Biology logo, the Ministry of Religion logo, and the MA Ihyaul Ulum logo. Apart from that, the sticker that was made also contained the name Biology KIT. The appearance of the sticker design in the Canva application can be seen in Figure 1.

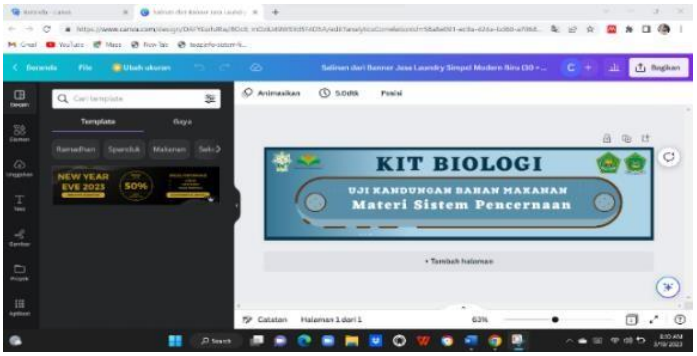


Figure 1. Sticker design in the Canva application

Apart from designing stickers, the Canva application is also used by researchers to design student worksheets. The Canva application is used to design covers, pages, contents, and layouts worksheet material. The Canva application that is used by researchers has also provided objects in the form of interesting pictures so that it helps researchers in editing Student Worksheets.

In addition to the Canva application, researchers also use the QR-Generator website to create QR codes contained in Student Worksheets. This website can be accessed free of charge via https://me-qr.com/id/. The QR code contained in the Student Worksheet can be read using a cellphone camera. When the QR code contained in the Student Worksheet is scanned using a QR code scanner or Google lens, it will lead to a YouTube channel that explains how the practicum will work. Each practicum starting from the carbohydrate (starch) content test, glucose test, protein test, fat test, and vitamin C test is equipped with each QR code. This QR code was created with the aim of facilitating students and teachers in carrying out practicums. The Student Worksheet which is made in outline consists of a cover, preface, table of contents, contents of the Student Worksheet, and bibliography. These components can be seen in the following figure.

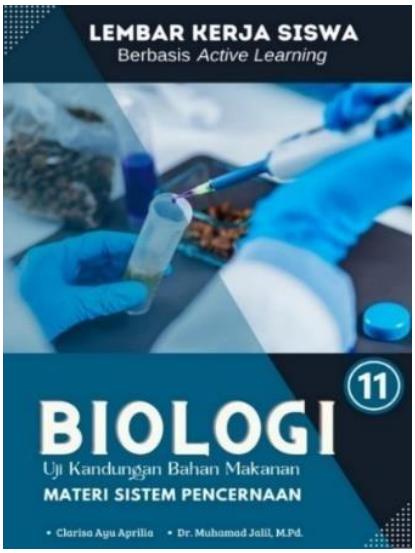


Figure 2. Cover
(Personal Doc., 2023)

Figure 3. Preface
(Personal Doc., 2023)

Figure 4. Table of contents
(Personal Doc., 2023)

Figure 5. Contents of the Student Worksheet in the Introduction section

(Personal Doc., 2023)

Figure 6. Fill in the Student Worksheet in the Let's Experiment section

(Personal Doc., 2023)

Figure 7. Fill in the Student Worksheet in the Independent Assignment section

(Personal Doc., 2023)

Figure 8. Bibliography

(Personal Doc., 2023)

After all the design is complete, then produce the initial product in the form of an Active Learning-Based Biology Learning KIT which can be seen in Figures 9 and 10.

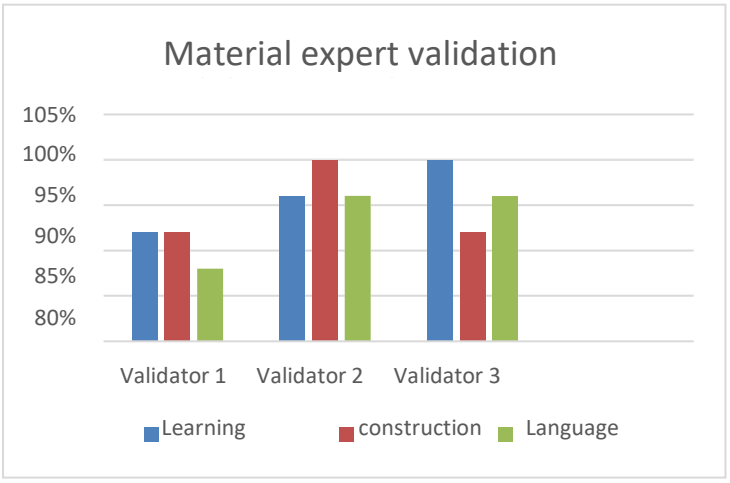
Figure 9. External appearance of the PBAL KIT initial product

Figure 10. Appearance of the initial product PBAL KIT

After producing the initial product in the form of an Active Learning Biology-Based Learning KIT, then the product is validated by experts to obtain an assessment of product validity. The validity of the developed Biology KIT product can be determined based on the results of completing a questionnaire by material experts and media experts. Each expert fills out an assessment questionnaire consisting of 3 aspects with 15 indicators.

a) Material expert validation

Material expert validation is carried out by competent Biology Tadris Study Program Lecturers, as well as experienced Biology subject teachers. Data from expert material validation results are presented in graphical form, which can be seen in Graph 1.

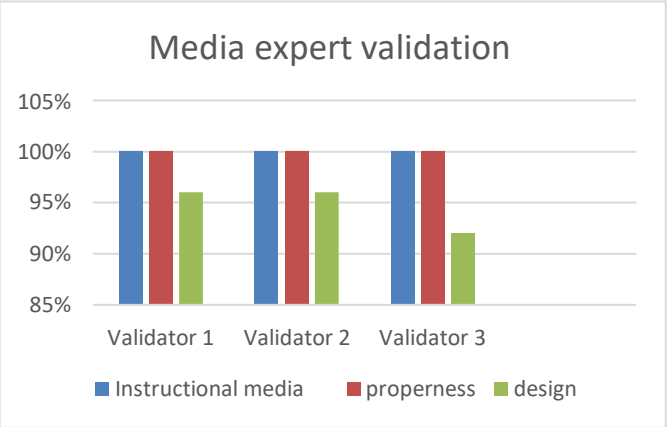


Graph 1. Material expert validation results

At this stage, material experts provide an assessment of the products developed by researchers. When the validation results of the 3 validators are averaged, then the learning aspect gets an average value of 96% with very valid criteria. Then the construction aspect gets an average value of 95% with very valid criteria, and the language aspect gets an average value of 93% with very valid criteria.

b) Media expert validation

Media expert validation was also carried out by competent Biology Tadris Study Program Lecturers, as well as experienced Biology teachers. Media expert validation results data are presented in graphical form which can be seen in graph 2.



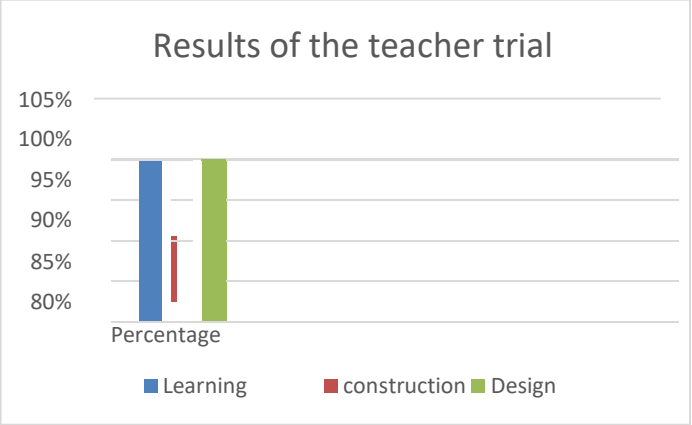
Graph 2. Media expert validation results

At this stage, media experts provide an assessment of the products developed by researchers. Aspects of learning media get an average value of 100% with very valid criteria. Then the feasibility aspect also gets an average value of 100% with very valid criteria. While the design aspect gets an average value of 95% with very valid criteria.

In addition to validity, the practicality of the product was also tested by testing it on teachers and students. The practicality of the developed PBAL KIT product can be known based on the results of filling out the questionnaire by teachers and students. Both teachers and students were asked to fill out an assessment questionnaire consisting of 3 aspects with 15 indicators.

a) Trial the use of the product by the teacher

The questionnaire given to the teacher consisted of aspects of learning media, construction and design. Data on the results of using the product by the teacher can be seen in graph 3.

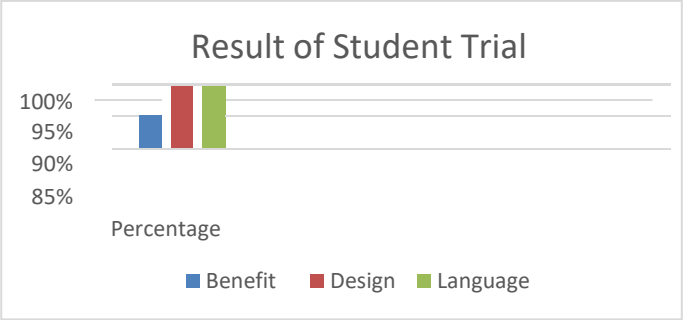


Graph 3. Results of the teacher trial

Based on the results of the calculation of the test questionnaire for product use by teachers, it was found that the aspect that received the highest rating was the aspect of learning media and design, with a value of 100%. This shows that the aspects of instructional media and design are very feasible. Meanwhile, the construction aspect scored 88% in the very decent category.

b) Test the use of the product by students

Testing the use of products by students is carried out by means of class-scale trials. Product trials on students were carried out with the aim of knowing the practicality of the Biology KIT products developed by researchers. The results of the class scale product trial results can be seen in graph 4.



Graph 4. Results of student trials

Based on the results of the calculation of the product use test questionnaire by students, it was found that the aspect that received the highest rating was the language aspect, with an average value of 95% in the very practical category. Meanwhile, the design aspect gets an average score of 94% in the very practical category. The lowest average is in the benefit aspect with an average value of 91%, and is included in the very practical category.

Another similar study by Adelia Yesya Putri Hasibuan & Iis Siti Jahro in 2020 with the title "Development of a Learning KIT from Rice Husk Waste on Molecular Form Material for Class X High School" which explained that all aspects which were media eligibility criteria based on the Ministry of Education and Culture obtained a percentage of 96.87% so that the Learning KIT on molecular shape material that was developed meets the Very Eligible criteria to be used as a Chemistry learning medium, especially on molecular shape material. While in the aspect of relation to subject matter, durability, efficiency, aesthetics and safety of tools for students get a perfect score with a percentage of 100% (Hasibuan & Jahro, 2020).

The use of learning media used by students must be adjusted to the specified curriculum. The Biology KIT product as the final product in this study was prepared on the basis of Active Learning. This is adapted to the objectives of the 2013 Curriculum, which is to prepare Indonesian people who have personal faith, are productive, creative, innovative, affective, and are able to contribute to the life of the nation, society, state and world civilization.

Learning the 2013 curriculum with a scientific approach is expected to be able to encourage students to find out for themselves through observation or experimentation. This has very close relevance to educational theory which forms the basis of education (A. Sulaeman, 2015). Overall, the Biology Learning KIT based on Active Learning produced is in the very valid and very practical category based on validity and practicality tests, and is able to support Biology learning for teachers and students. The Biology KIT product based on Active Learning that has been developed is also able to make students more active by being directly involved in practicum activities. In addition, Biology Learning Kit media based on Active Learning can help overcome the problem of not having a laboratory in schools.

CONCLUSION

Based on the results of the research that has been done, a Biology-Based Active Learning Learning KIT product is produced which is equipped with a Student Workshee on digestive system material, especially the sub-chapter on food testing. The Biology-Based Active Learning Learning KIT product that was developed, obtained an assessment in the category of very valid and very practical. The validity of the KIT was seen from the results of the validator's assessment which consisted of 2 expert lecturers and 1

expert teacher with an average score of 95% based on the material expert's assessment and an average score of 98% based on the media expert's assessment. While the practicality of KIT is seen from the results of teacher and student trials. KIT media developed in the very practical category with a score of 96% based on teacher trials and 93% based on student trials.

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