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Evaluation of the Validity of Bioplastic Learning Media for Identifying Marine Invertebrates

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Abstract
This research and development study aims to create a valid bioplastic learning medium for marine invertebrates, tailored to students' needs in identifying animals in animal taxonomy courses. Marine invertebrates, particularly those from the Gastropod class, were collected through exploratory research along the southern coast of Blitar, preserved in resin, and supplemented with morphological characteristics. The study follows the 4D development model (Define, Design, Develop, Disseminate) proposed by Thiagarajan (1974). In developing the product, the researchers conducted material validation, media validation, and practicality testing. Two lecturers carried out the validation process, and the data obtained was analyzed using quantitative descriptive methods. The validation results showed scores of 0.80 for material and 0.84 for media, both classified as high. Therefore, the bioplastic learning media for marine invertebrates can be utilized to assist students in identifying animals and achieving learning objectives. However, further testing is required to ensure its effectiveness in enhancing students' skills.

Keywords: bioplastic learning media, gastropod, validity

1. INTRODUCTION

Instructional media is an important part of the learning process. The application of instructional media has improved the learning quality (Isa & Rustini, 2023) and has influenced student learning outcomes (Nurrita, 2018) (Wulandari et al, 2023). The application of instructional media in the classroom has facilitated the delivery of material and increased the efficiency of the learning process (Astuti, 2017) (Masfufah et al., 2022). Most teachers (75%) do not utilize learning media in biology learning (Fitriyanti et al., 2021). Most biology teachers have implemented learning without teaching aids because they have no time to provide them or the school does not have adequate tools/materials.

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Meanwhile, some teachers give other reasons, namely the lack of knowledge and experience in developing instructional media or teaching aids (Putu et al, 2024). Some biology materials are abstract (Wahyuni & Yokhebed, 2019), require tools and materials that cannot be obtained quickly, and must meet standards (Herditiya et al, 2023).

The course on animal taxonomy is theoretical and practical. Practical activities were carried out in the laboratory and field studies in the sea have been on invertebrate diversity. Learning activities in the laboratory were identified and classified as fresh invertebrate animals found in the environment. Students often experience obstacles in providing fresh invertebrate animal specimens for practical activities. The required animal specimens were difficult or impossible in the environment because it was not the season or the weather conditions at sea were not supported. Field studies are usually carried out on the southern coast of Blitar, such as Peh Pulo Beach, Banteng Mati Beach, and Gondo Mayit Beach in Blitar Regency. Continuous use of fresh specimens can reduce the population of marine invertebrates, even in the learning process using fresh specimens is required to be faster because the animal's resistance cannot last long so the learning process is less than optimal. Taking fresh invertebrates can impact the ecosystem (Luthfi et al, 2018).

Invertebrate animal specimens that are not too small and are not structurally damaged when dry can be preserved in resin blocks (bioplastic). Bioplastic is a learning medium in the form of preserved plants or animals in clear resin blocks (Hailu, 2012). Preserved marine invertebrates using bioplastic are included in dry preservation. This dry preservation is a reality media that can provide real experiences to students by conducting direct observations of objects (Yuanawati, 2017). The advantage of bioplastic media is that preserved animal specimens can be seen from all sides and specimens blocked in resin will be preserved longer than wet preserved specimen media (Setiati, 2021). Three-dimensional bioplastic media can provide a strong stimulus for students to learn the material.

The use of resin blocks or bioplastics in making specimen media for biological objects has been developed for invertebrate animals (Musannadah, 2018); mollusks (Antasari et al, 2017); insect animals (Hamidah, 2020); and arthropod animals (Israri et al, 2017). The biological object specimen implementation will increase students' interest in learning biology, and develop students' skills in observing, describing structures, measuring, classifying, finding problems, and interpreting data. The results of research from Artasari, et al (2017) explained that the development of media for preserving mollusks with resin motivated students in the learning process which was tested by material experts with a percentage of 85.22% (very feasible category), media experts with a percentage of 77.88% (feasible category), individual testing with a percentage of 93.33%, small group testing 93.32%, and large group testing with an average percentage of 91.84%. This research is also strengthened by research into the development of Hamidah, et al (2020) that bioplastic learning media in the form of contextual key chains with insect material can increase students' interest and motivation in studying animal material with the results of small group trials showing a percentage of 80.27%, and the large group trial obtained a percentage of 90.25%.

Based on the description above, the researcher is interested in developing bioplastic media for invertebrate animal specimens found on the southern coast of Blitar Regency, especially the Gastropod class. This research aims to determine the validity of bioplastic media for Gastropod class specimens as a medium for identifying animal taxonomy.

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2. LITERATURE REVIEW

Learning media is a learning aid that functions to make it easier for teachers to convey messages or information related to learning in class. According to Sumiharsono & Hasanah (2018) learning media is a carrier of messages or information that aims at learning or contains learning purposes. Then, the learning media is anything that can be used to learning materials, so that it can stimulate attention, interest, thoughts and feelings of learning in learning activities to achieve certain goals. This media is designed to attract students' attention so that students don't get bored studying insect material. This method is quite effective in arousing students' interest in learning and is included in good learning media when the media can overcome the limitations of the senses, space and time and can clarify the presentation of the message (Arsyad, 2014). Susilana & Riyana further stated (2009) that through media the learning process can be more interesting and enjoyable, so that students feel as if they are not learning. According to Sardiman (2014) learning media can overcome students' passive attitudes and enable students to learn on their own according to their abilities and interests. Learning media can also play a role in concretizing something abstract (Yuanawati, 2017). Furthermore, media can help overcome the limited experience that students have, enable direct interaction between students and their environment, produce uniformity, foster a desire and interest in learning, can instill correct, concrete and realistic basic concepts, and stimulate students to learn (Arsyad, 2014). The use of learning media can improve the quality of the learning process which can ultimately influence the quality of student learning outcomes.

The use of media in the form of preserved specimens is very necessary to reduce the extinction of marine invertebrate animal populations. Preserved specimens of marine invertebrates can be stored for a long time and can be used many times, reducing the workload of teachers and students, increasing efficiency, and increasing student enthusiasm for learning. One of the preservation media that can be used to package and preserve marine invertebrates in their original form is using bioplastic media. Bioplastics are learning media in the form of preserved plants and animals in clear resin blocks (Hailu, 2012). Preserving marine invertebrates using bioplastics is included in dry preservation. This dry preserve is a reality medium that can provide real experience to students by making direct observations of objects (Yuanawati, 2017). This bioplastic media is a three-dimensional media that can provide a strong stimulus for students in studying the material. The advantage of bioplastic media is that preserved animal specimens can be seen from all sides and specimens that are blocked in resin will be preserved longer than wet preserved specimen media (Setiati, et al, 2021). Bioplastic media has three advantages, namely, it can be stored for a long period of time so that the shape and color do not change, the specimens are taken in selected places in abundance and in the right season so as not to disturb the environmental balance, and this bioplastic media can show parts -an important part of an important object to be observed so that it can be used for observation activities, data collection, concept application, classification and communication (Nazila, 2017). Bioplastic media has many advantages compared to fresh media and is very productive as a learning medium for students. Even though this media has many advantages, this media also has several weaknesses, including that this media can cause an unpleasant odor because it comes from chemicals, this media must be made really carefully because it cracks easily and the color is blurry, this is very difficult to observe. specimen if the color is opaque or cloudy (Nazila, 2017). To minimize the shortcomings of using bioplastic media, the novelty of this research is the use of liquid lycal resin which has a low temperature so that marine invertebrate specimens do not

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change color. In addition, the bioplastic media includes the size and taxonomy of each specimen. The advantage of lycal resin is that it does not have a strong odor, the color is clearer (Kamilah, et al, 2023).

3. METHODS

The type of research used in this study is Research and Development (R&D), a method aimed at creating a specific product and testing its effectiveness (Haryati, 2013). This research procedure used 4D model with stages Define, Design, Develop, Diseminate (Thiagarajan, 1974), but was limited to the Develop stage. This research was implemented in April −September 2024, at Balitar Islamic University, Blitar. Specimens of gastropods preserved in bioplastic are the result of exploratory research in the South Coast Coastal area of Blitar Regency. The instruments used for collecting data included material validation sheets, media validation sheets, and practicality test questionnaires for lecturers and students. The gastropod bioplastic media was validated by media experts and material experts. Data analysis using quantitative descriptive methods with the following equations and criteria.

The media validity score was determined by the Aiken's V formula:

$$V = \frac{\Sigma s}{\{n(c-1)\}}$$

Description: $s = r - lo$

r = number given by the experts

lo = lowest validity assessment number (example 1)

n = number of experts

c = highest validity assessment number (example 5).

Media validity criteria referring to Aiken (1985) were presented in Table 1.

Table 1 Media Validity Criteria

Score Interval	Validity Criteria
V ≥ 0,80	High
0,40 < V < 0,80	Medium
V < 0,40	Low

4. RESULTS

The QR Code-based bioplastic learning media for marine invertebrates was specifically designed to assist students in identifying invertebrate animals, particularly those in the class Gastropod, by combining physical specimens with interactive digital content. This media consisted of gastropod specimens placed in molds measuring 5.5 cm x 8.5 cm, which were then filled with resin to create a three-dimensional medium (Figure 1). The specimens were crafted with precise morphological details, complete with measurement guidelines, morphological characteristics on the underside of the specimens.

Figure 1 The bioplastic media

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The validation results of the QR Code-based bioplastic learning media for marine invertebrates were obtained through assessments by a team of experts consisting of media experts and material experts. The validation was conducted using a validation assessment instrument designed by media experts, which covered three main aspects: media design, interaction use, and readability. The validation assessment instrument prepared by material experts included aspects of format, quality of content or materials, and learning objectives. Each aspect was evaluated using a Likert scale with categories of very valid, valid, quite valid, less valid, and not valid.

Table 3 Results of Validation by Media Experts

Aspects	V Score	Criteria
Media design	0,85	High
Interaction use	0,80	High
Readability	0,78	Medium
Average	0,80	High

Table 4 Results of Validation by Material Experts

Aspects	V Score	Criteria
Format	0,84	High
Quality of materials	0,85	High
Learning objectives	0,82	High
Average	0,84	High

5. DISCUSSION

The development of technology-based learning media involving students motivated them to enhance their skills related to digital technology (Olszewski & Crompton, 2020) (Schmid & Petko, 2019). The bioplastic learning media aimed to provide a solution for improving students' identification skills, particularly in identifying animals of the class Gastropod.

Based on the validation results (Table 3 and Table 4), the average validation score from the two experts have shown the media was included in the high criteria. Several studies have shown that validation by material experts and media experts produces products that are valid and suitable for use in learning (Anantyarta & Sholihah, 2020; Panjaitan et al., 2020). Media experts expressed their appreciation for the visual design of the bioplastic specimens. In all aspects of material validation, high scores were obtained. In the material aspect, the expert assessed that the material presented was in accordance with the learning needs of marine invertebrates at the university. The validation results have shown that the bioplastic learning media meets scientific standards and has quality that meets the needs of users in the learning. Validation has helped create learning media that is interesting, adaptive and appropriate to students' needs (Jannah & Reinita, 2023). These results are relevant to research results (Nurrita, 2018) which stated that the use of valid learning media can increase the effectiveness of the learning process and motivate students to be more active in exploring the material. Although in general the validity results are considered high, there are several suggestions provided by the validator for improvement. One suggestion is that it be supplemented with additional materials such as videos, digital illustrations and more detailed species descriptions This input has been accommodated by researchers to improve the quality of the media before it is used in the practicality test.

Overall, learning with bioplastic media provides an innovative solution to support a more interactive and contextual learning process. These findings support the literature which states that visual media in biology education was found to accelerate understanding, attract attention, strengthen memory, and illustrate materials effectively (Naimnule et al., 2023). As stated by Santhalia & Sampebatu (2020) combining physical specimens and interactive digital content can improve student understanding through deeper learning experiences. The advantage of this media also lies in the fact that the bioplastic material provides a more realistic visual impression, thus helping students in analyzing the morphological structure of specimens.

Although this medium shows significant advantages, there are several limitations that need to be considered.The research only covers one semester, so the effectiveness of media in supporting long-term learning cannot be confirmed. These limitations provide opportunities for further development by involving more students and expanding the scope of trials to evaluate the effectiveness of media in diverse learning contexts.

6. CONCLUSION

The bioplastic learning media has a quality that suits students' learning needs. The results of the validation by material experts 0.80 and the results of the validation by media experts were 0.84, which are included in the high criteria. However, it still needs to be equipped with a guide to start using the media. Overall, marine invertebrate bioplastic media supports learning outcomes and improves students' learning experiences in the digital era. Furthermore, trials to measure the effectiveness of the media in various learning contexts need to be conducted.

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