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Usability of Learning Media for Student Worksheets in the Aquatic Biology Course Based on a Mollusca Inventory at Sindangkerta Beach, Tasikmalaya

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ABSTRACT
The limited availability of Student Worksheets (LKM) in the Aquatic Biology course makes learning less effective for students, as there are no supporting worksheets, resulting in decreased motivation and interest in learning. This study aims to develop an Aquatic Biology Student Worksheet based on a Mollusca inventory from Sindangkerta Beach, Tasikmalaya. The research employed a Research and Development (R&D) method using the 3D model (Define, Design, and Develop). The subjects of this study were 15 sixth-semester students from the Biology Education Study Program at UIN Sunan Gunung Djati Bandung. The results include a description of the development stages (Define, Design, and Develop) of the LKM product; data analysis of the validation process by material and media experts indicated that the worksheet was valid, with an average score of 83.79%. The student readability aspect was categorized as easy to understand (91.2%), and student responses fell into the very positive category (88%). Based on the findings, it can be concluded that the LKM based on the Mollusca inventory at Sindangkerta Beach, Tasikmalaya, is suitable for use as a learning medium in Aquatic Biology courses..

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Introduction

The national education system positions higher education as a strategic component vital for educating the nation. Students, as the primary pillars of the nation's next generation, hold a central role, making the enhancement of their potential crucial. Higher education institutions are therefore required to implement innovative learning designs to optimally achieve learning objectives and competencies (Simatupang & Yuhertiana, 2021; Mulyasa, 2021). Learning success, which embodies students' achievement of objectives and competencies and educators' success in guiding them, heavily relies on the availability of adequate learning tools. This aligns with Law No. 12 of 2012, Article 41 Paragraph 1, which mandates that learning resources must be accessible within higher education environments and possessed by universities in accordance with their study programs.

A preliminary study with the Aquatic Biology course lecturer revealed a significant lack of Student Worksheets (LKM) for the course. This presents a pressing problem, as the classroom learning process feels ineffective due to insufficient engaging learning media, leading to low student motivation and interest. Student Worksheets are vital learning support components that help students understand material through structured activities (Asnaini, 2017). Furthermore, students expressed a desire for visual-based learning media, especially for outdoor learning activities, to serve as a crucial reference.

The Aquatic Biology course, offered in the Biology Education Program at the Faculty of Tarbiyah and Teacher Training, UIN Sunan Gunung Djati Bandung, covers marine and freshwater ecosystems (Wulandari, 2020), including topics like Marine Biodiversity II (plankton and invertebrates). Molluscs, a significant invertebrate group, play a vital role in ecosystems and possess considerable economic value. Given their importance and the potential for overexploitation, students in the Biology Education Program need profound knowledge of this fauna.

The development of a Student Worksheet (LKM) is proposed as a solution to address these issues. This LKM will focus on Mollusc material within the local context of Sindangkerta Beach, a relevant site for aquatic biota studies. This LKM is expected not only to enrich student learning materials and broaden their scientific knowledge of Molluscs in a real-world setting but also to provide a more engaging and relevant learning experience.

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Methods

This This study employed a Research and Development (R&D) method to produce and test the effectiveness of a learning product (Sugiyono, 2019). This R&D refers to a modified 3D stage model (Define, Design, and Development) as cited by Astini et al. (2020), which is adapted from the original 4D model (Define, Design, Development, and Disseminate) by Thiagarajan (1974).

The research was conducted from February to April 2024 at UIN Sunan Gunung Djati Bandung, involving 15 sixth-semester students from the Biology Education Program, Faculty of Tarbiyah and Teacher Training, who had previously taken the Aquatic Biology course.

Procedure

Define Stage

This initial stage involved a needs analysis. A preliminary study, conducted through interviews with the Aquatic Biology course lecturer, revealed the absence of Student Worksheets (LKM) for the course. Students also expressed a need for engaging and visual learning media, particularly for outdoor activities, highlighting the urgency for relevant and innovative material development.

Design Stage

In this stage, learning objectives, material scope, and activities were designed. Content focused on marine biodiversity, specifically Mollusca. The Student Worksheet (LKM) draft was compiled based on curriculum, learning outcomes, and student needs. Validation instruments for material and media experts, along with student readability and response questionnaires, were also prepared.

Development Stage

This stage involved validating the LKM draft by subject matter and media experts. The product was revised based on their feedback. Following revisions, the LKM underwent readability and response testing with student samples to assess its comprehensibility, engagement, and relevance. Further improvements were made based on this feedback.

Data Analysis

The instruments used in this study included interview sheets, validation questionnaires for subject matter and media experts, and readability and student response questionnaires. Data analysis utilized the Likert scale to measure opinions, attitudes, and views (Riduwan & Sunarto, 2019). Specifically, a 4-point Likert scale was employed, consisting of the following response options: Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4).

The obtained scores were then recapitulated, analyzed using appropriate formulas, and converted into percentages. The findings were subsequently described and presented in figures and tables.

Results and Discussions

Define Phase

The Define phase involved a comprehensive analysis to identify the need for the Student Worksheet (LKM) and establish its foundational elements.

Front-end Student Analysis

A preliminary study, through interviews with the Aquatic Biology course lecturer, revealed a critical absence of supporting student worksheets (LKM), particularly those designed for the Aquatic Biology course. This indicated a strong necessity for developing such instructional materials. Further interviews with two biology education students who had previously taken the Aquatic Biology course confirmed that the existing learning process felt ineffective due to the lack of engaging learning media and dedicated worksheets, which consequently led to low student motivation and interest.

Task and Concept Analysis

The LKM material focuses on marine biodiversity II (plankton and invertebrates). The core concept involves understanding and analyzing marine biodiversity, specifically Mollusca, and differentiating it from freshwater biota. This aligns with the sub-course learning outcome (Sub-CP-MK) where students are expected to comprehend and analyze marine plankton and invertebrate biodiversity, and distinguish them from freshwater biota.

Specifying Instructional Objectives

The learning objectives and indicators (IPK) are outlined in Table 1.

Table 1. IPK and Learning Objectives of LKM

No.	Learning Indicator (IPK)	Learning Objectives
1.	Analyzing biodiversity of marine plankton and invertebrates	Students can organize marine invertebrates of Mollusca phylum by image, morphology, and habitat accurately.
2	Analyzing habitat of plankton and invertebrates	Students can describe the habitat of Mollusca accurately.
3	Differentiating marine and freshwater biota	Students can differentiate marine and freshwater Mollusca based on environmental adaptations.
4	Determining aquatic biology sampling methods	Students can determine sampling methods through practical field inventory of Mollusca.

The initial analysis clearly highlighted a significant gap in the instructional materials for the Aquatic Biology course: the absence of dedicated Student Worksheets (LKM). This deficiency, as noted by both lecturers and students, directly contributed to perceived ineffectiveness in the learning process and diminished student engagement. This finding strongly supports the underlying premise for developing an LKM, as worksheets are recognized as essential instructional tools that maximize student activity and aid comprehension through concise content and practice tasks (Prastowo, 2012). Furthermore, well-structured and visually appealing worksheets are known to enhance active student participation and motivation (Barlenti & Hasan, 2017), directly addressing the motivational issues identified.

The focus on Marine Biodiversity II (plankton and invertebrates), specifically Mollusca, for this LKM is academically justified for several reasons. Firstly, this topic inherently involves field study activities, making an LKM a particularly suitable and practical medium for learning. Traditional classroom settings often fall short in conveying the complexities of real-world biodiversity. Secondly, Mollusca represent a significant invertebrate group with considerable ecological and economic importance. Their presence in the intertidal zone, such as at Sindangkerta Beach, provides an accessible and relevant local potential for direct observation and study. Utilizing local potential as a learning resource facilitates the learning process by offering direct interaction with the subject matter (Selpiya et al., 2019). This hands-on, contextually rich approach, as emphasized by Febrian et al. (2020), makes the learning of topics like marine biodiversity (Mollusca) more applicable and meaningful compared to purely theoretical instruction. The close linkage to real-life contexts fosters deeper understanding and critical thinking about conservation and ecological roles.

Design Phase

In this stage, the first prototype (Prototype 1) of the student worksheet (LKM) was developed. This involved formulating test standards based on the define stage analysis, selecting appropriate media, determining the format, and creating the initial design.

The LKM was designed with specific criteria: it integrates information on local potential, particularly marine invertebrates (Mollusca) from the intertidal zone of Sindangkerta Beach, Tasikmalaya. Emphasis was also placed on an attractive layout and color scheme, clear articulation of learning outcomes and instructional objectives, and the inclusion of learning activities that stimulate curiosity and promote independent learning among students.

An intertidal Mollusca inventory-based student worksheet was selected as the primary medium. The worksheet's format was created using Canva software on A4-sized paper, employing Raleway and Acid Bold fonts (sizes 45, 20, and 11, with 1.4 line spacing). This initial design, Prototype 1 (Figure 1), is subject to revision and improvement following expert validation, aligning with the principle of identifying and correcting failures early in the development process (Amalina et al., 2017).

Figure 1. Initial design of the Aquatic Biology LKM based on Intertidal Mollusca Inventory

Develop Phase

The development stage encompassed validation testing and product trials (readability and student response tests). The LKM was refined based on suggestions and input received from expert validators, with comments reviewed and incorporated to enhance product quality.

The content expert validator noted a need for clearer explanation of the material. This feedback is crucial, as the clarity of concepts is a hallmark of high-quality educational text (Handoko, 2016). Unaddressed misconceptions can negatively impact subsequent learning processes, underscoring the importance of conceptual precision in the LKM.

Meanwhile, suggestions from the media expert validator primarily focused on visual aspects. These included revising writing structure, judicious use of conjunctions, avoiding abbreviations, proper Latin name formatting, consistent tabulation, and maintaining font type and size consistency. These recommendations align with established principles for developing effective student worksheets, which emphasize technical requirements such as readable text, appropriate font sizes, proportional images, and an attractive overall layout (Surachman in Nurdin et al., 2016).

Based on the combined validation analysis, the developed Aquatic Biology LKM achieved a "very valid" category with an average validity percentage of 83.79% (Table 2). Individually, the content expert assessed it as "very valid" (90.67%), and the media expert as "valid" (76.92%). According to Riduwan & Sunarto (2019), a product with an eligibility percentage exceeding 61% is considered "valid" (strong category). These results indicate the LKM's robust foundational quality, demonstrating its theoretical and practical soundness before student implementation (Figure 2a & 2b).

Based on the validation analysis results from content and media expert validators, the developed Aquatic Biology LKM was categorized as "very valid" with a validity percentage of 90.67%. According to the validation score interpretation criteria by Riduwan & Sunarto (2019), if the eligibility percentage > 61%, the product is declared "valid" as it falls into the strong category. The validation results from both expert validators are shown in Table 2.

Table 2. Analysis of Expert Validation Questionnaire Results

No.	Validator	Validator Percentage	Category
1.	Content Expert	90.67%	Very Valid
2.	Media Expert	76.92%	Valid
	Average	**83.79%**	**Very Valid**

Each component of the validation aspects had varying scores “Figure 2a (left), & 2b (right):

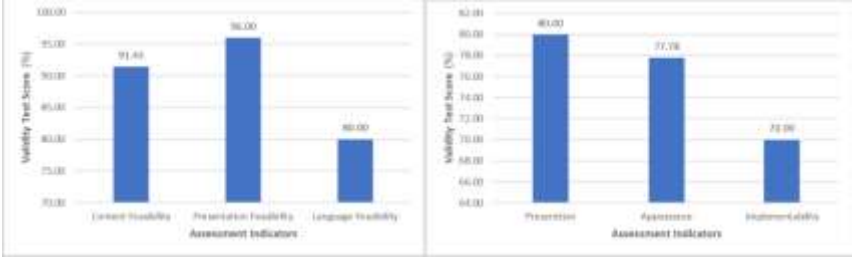

Figure 2. Validation Results of the Student Worksheet (LKM); a) Content Expert, b) Media Expert

Material eligibility was further assessed against BSNP criteria (Urip Purwono, 2008), covering presentation techniques, learning presentation, coherence, and logical flow. The content expert affirmed that the LKM's material presentation, especially for Mollusca inventory, met these criteria, with clear material flow. This confirms the LKM's ability to effectively present concepts and illustrations (Almira, 2018), thereby aiding student comprehension. Similarly, the LKM's feasibility based on presentation, graphic appearance, and implementation was deemed "valid" by the media expert. While the technical quality (appearance) was good, a notable comment concerned dense and disproportionate image placement and descriptions. This led to revisions aimed at adjusting text-to-image proportions, consistent with recommendations for balanced layouts (Simamora et al., 2018). It also reinforces the principle that LKM pages should avoid overloading with irrelevant content to facilitate student focus and concept understanding (Waroka et al., 2020).

The developed LKM product was then tested in a small-scale trial involving 15 sixth-semester Biology Education students from FTK UIN Sunan Gunung Djati Bandung, who had previously taken the Aquatic Biology course, to assess readability and student responses. The readability test results are shown in Table 3, and student response data are presented in Table 4.

Table 3. Student Readability Results of the LKM

No.	Assessment Aspect	Percentage	Description
1.	Appearance	89.3%	Easy to Understand
2.	Presentation	93.3%	Easy to Understand
3.	Language	91%	Easy to Understand
	Average	**91.2%**	**Easy to Understand**

Table 4. Student Responses to the LKM

No.	Assessment Aspect	Percentage	Description
1.	Attractiveness of Appearance	91.3%	Very Good
2.	Comprehension of Content	87.6%	Very Good
3.	Student Motivation	84.9%	Very Good
	Average	**88%**	**Very Positive**

The validated LKM product then underwent a small-scale trial with 15 sixth-semester Biology Education students to assess readability and student responses. The readability test yielded an average percentage of 91.2%, categorizing the LKM as "easy to understand" (Kusjuriansah & Yulianto, 2019) (Table 3). This high readability confirms the LKM's potential to effectively support the learning process by ensuring clear comprehension of learning objectives and content alignment with the curriculum (Fajri et al., 2018). Clear presentation, appearance, and language are crucial for student comprehension and engagement.

Student responses further validated the LKM's effectiveness, with an overall "very positive" average of 88% (Table 4). The highest score was for the attractiveness of appearance (91.3%), indicating the LKM's success in capturing student attention and boosting motivation. This aligns with the idea that well-designed learning materials enhance classroom learning quality by meeting student needs (Sadjati, 2006). The LKM's attractive layout, proper text and image arrangement, and legible font and color choices were critical in increasing student motivation to study the material, demonstrating a positive impact beyond mere content delivery.

Conclusions

Based on the results of this study, it can be concluded that the Student Worksheet (LKM) based on the intertidal Mollusca inventory at Sindangkerta Beach, Tasikmalaya, is suitable for use as a learning medium in the Aquatic Biology course. The LKM received a validity score of 83.79% from expert validators in content and media, indicating it is valid. Readability testing among students showed a score of 91.2%, categorized as easy to understand. Student responses were highly positive, with a percentage score of 88%. These findings confirm that the developed LKM is appropriate for academic implementation in Aquatic Biology learning.

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