

Development of BioPhy Magazine Containing Local Wisdom to Improve Problem Solving Ability and Promote Environmental Awareness Campaign

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Abstract: The purpose of this study was to describe the validity and effectiveness of BioPhy Magazine based on local wisdom, which was developed to improve problem-solving skills and encourage students to conduct environmental awareness campaigns. This type of research was development research with the Tessmer formative evaluation model. The small group trial subjects are Chemistry Tadris students who are taking Basic Physics courses in the 2021/2022 academic year. Data were obtained through validation sheets, problem-solving tests, and poster assessment sheets. The data were then analyzed using the Aiken formula, N-gain, effect size, and Wilcoxon test. The results of the analysis showed that the developed magazine was valid from the aspect of content, presentation, and language. Magazines were also effective in improving problem-solving skills, with an N-gain score on the small group test of 0.90 with a high category and an effect size of 3.34 with a strong influence category. In addition, based on the Wilcoxon test, it was known that Asymp. Sig. (2-tailed) of 0.005, which meant that there was a significant difference in problem-solving ability between before and after learning. In addition, magazines could encourage students to carry out environmental awareness campaigns as indicated by the average student environmental poster score of 95.38. So, BioPhy Magazine was valid, effective, and successful in encouraging students to carry out environmental awareness campaigns.

Keywords: BioPhy Magazine; Local wisdom; Problem-solving; Environment awareness campaign

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Introduction

South Kalimantan is one of the provinces in Indonesia that has unique local wisdom. The local wisdom is the Floating Market, which is a market that trades on the river using a *jukung* (a typical South Kalimantan river transportation tool). (Budiman, et al., 2019; Angriani, et al., 2021; Fathoni, et al., 2017; Abbas, et al., 2021). Apart from being local wisdom, market,

and tourist attraction, the Floating Market can also be a source of learning physics and biology.

Misbah, et al. (2018) and Hartini, et al. (2019) had studied the concepts of physics, especially the fluids found in the Floating Market. Not only that, the physics concept was then poured into the form of a learning module (Hartini, et al., 2019). In addition, at the Floating Market, people can find a variety of flora diversity in the form of plantation and agricultural products (Abbas, et al., 2021) and the diversity of fauna

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in the form of swamp fish (Arisanty, et al., 2020; Abbas, et al., 2021). The environment around this market is also a river ecosystem. This makes the Floating Market a source of environmental learning because it functions as ecotourism (Normaleni, 2016). Nowadays, ecotourism can be used as a means to study ecology, nature conservation, biodiversity, and environmental awareness (Stronza, et al., 2019).

One of the learning media that can be used to convey messages to students is a magazine. The hallmark of a magazine is that it contains writing that is packaged in communicative language and is equipped with colorful pictures (Prasetyana & Corneliawati, 2018). In addition, the magazine is getting more interesting by containing questions that are packaged in the form of games, such as quizzes and crosswords (Akbar & Mukminan, 2019).

Based on the lecturer's assessment, it was known that the problem-solving ability on fluid topics was still low. This was also the same with research Sutarno, et al. (2021). This was because students found it difficult to represent problems (Bollen, et al., 2017) and difficult to solve new problems that were different from the examples that had been studied (Ince, 2018). In addition, Hafizah & Annur's (2018) research showed difficulties in explaining problems through related physics concepts, determining formulas that can be used, planning appropriate solutions, and solving different cases with the same equation. Setyarini, et al. (2021) also mentioned that the cause was the inability to absorb the knowledge he has learned because the process of receiving knowledge did not run independently. Problem-solving skills need to get serious attention because, with good problem-solving skills, they will be involved in mental activities in finding solutions (Rudibyani, et al., 2020).

The results of observations also showed that lecturers only teach physics material without relating it to environmental education. River environmental education needs to be done because the community does not participate in maintaining the river properly (Kurniawan, et al., 2021; Matnuh, et al., 2021). In addition, people still often pollute the river (Rahman, et al., 2019; Matnuh, et al., 2021; Sulaeman, et al., 2020).

The floating market has been researched by Misbah, et al. (2018), especially about the concepts of static fluid and dynamic fluid that occur in the market. Hartini, et al. (2019) has also developed a physics module that includes these concepts in the Floating Market. The rest, there has been no research that pours the concepts of physics in the market into the media in the form of magazines. The development of the magazine has also been carried out by Akbar & Mukminan (2019) about the effectiveness of biological electronic magazines, Sulisworo, et al. (2019) about the validity and attractiveness of physics magazines, and

Wahyuningsih, et al. (2019) about the feasibility and effectiveness of local wisdom-based biology magazines for high school students. However, no magazine simultaneously contained the concepts of physics and the environment based on the local wisdom of the Floating Market.

Previous studies have also conducted research on how to improve physics problem-solving skills, namely applying the Blended Learning model based on the collaborative inquiry tutorial. (Herayanti, et al., Local Wisdom-Based ELSII Learning Model (LWB-ELSII) (Fadli & Irwanto, 2020), local potential integrated module (Putri & Aznam, 2019), and the International Primary Curriculum module integrate local wisdom (Kristanto, et al., 2019). However, there has been no research on the use of Floating Market-based magazines to improve problem-solving abilities. Therefore, this research was carried out.

Likewise, with the cultivation of environmental awareness. Various studies have carried out various ways to instill environmental awareness, namely the application of environmental education (Manase, 2016; Saribas, et al., 2017; Ikhsan, et al., 2019; Boca & Saraçlı, 2019; Siswanto, et al., 2019; Sholahuddin, et al., 2021). In addition, the method used was by using social media (Hamid, et al., 2017; Ozdemir & Alkabbanie, 2017; Kaur & Chahal, 2018; Pavelle & Wilkinson, 2020; Nwachukwu, et al., 2021). Another way was to use science learning to promote environmental awareness (Ballard, et al., 2017). However, there was no research that uses magazines based on the local wisdom of *Pasar Terapung* to encourage environmental awareness campaigns. Therefore, this study developed a magazine containing environmental concepts and learning activities that encourage students to campaign for environmental awareness.

This research aimed to develop BioPhy Magazine media based on South Kalimantan Local Wisdom, namely Floating Market. In particular, this article discussed not only the validity but also the effectiveness of the magazine, which was developed to improve problem-solving skills and encourage students to carry out campaigns on environmental awareness, especially those related to river ecosystems.

Method

This research was development research with a model Tessmer (2016) as seen in Figure 1. This model consisted of 2 main stages, namely the preliminary stage and the formative evaluation stage. The formative evaluation stage consisted of self-evaluation, expert review, one-to-one test, and small group test.

Small group trials were carried out at the Tadris Chemistry Study Program, Faculty of Tarbiyah, and Teacher Training at UIN Antasari Banjarmasin, totaling

10 people from June to November 2021. They were studying Fluids in the Basic Physics course. The research instruments were validation sheets, problem-solving tests, and poster assessment sheets.

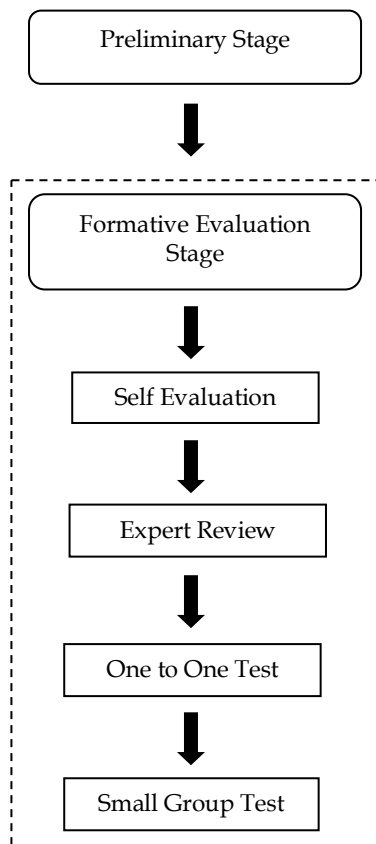


Figure 1. Stages of research

The validation sheet consists of the validation of content, presentation, and language components adapted from Badan Standar Nasional Pendidikan (2014). Each aspect was validated by 12 experts. Validation data was then analyzed by formula Aiken (1985), while the effectiveness of magazines in improving problem-solving skills was analyzed by N-gain (Hake, 1998), effect size (d), and Wilcoxon test (Leech, et al., 2005). This effectiveness was measured from the pretest and posttest ten problem-solving questions that included aspects of problem schema, analogy, argument, and causal (Jonassen, 2011; Jonassen, 2011).

In addition, student answers were assessed with a rubric Docktor, et al. (2016) which contained five processes of problem-solving abilities, namely useful description, physics approach, specific application of physics, mathematical procedures, and logical progression. Furthermore, the environmental awareness campaigns carried out by students were judged from the posters they made (Hess & Brooks, 1998; Ballard, et al., 2017; Lynch, 2018; Yildiz & Budur,

2019). Poster rating based on criteria Hess & Brooks (1998), Ariani, et al. (2019), and Wicaksana, et al. (2020).

Result and Discussion

BioPhy Magazine Based on Local Wisdom

The developed magazine was a print media with a total of 168 pages. The magazine components consisted of the beginning, the main part, and the end. The initial part consisted of a cover, the identity of the teaching materials, and a table of contents. The main part of teaching materials like a magazine consisted of various rubrics (Sulisworo, et al., 2019; Sari & Wati, 2020; Prasetyana & Corneliawati, 2018). The final part consisted of a bibliography and author profile. Figure 2 shows a magazine cover.



Figure 2. Front cover of BioPhy Magazine (Fitriah & Ita, 2021)

There were 55 rubrics with various topics but still based on the Floating Market. This variation was helpful in a growing interest in learning and making learning more dynamic (Sulisworo, et al., 2019). In addition, this variation also aimed to make the magazine look attractive. Hammond, et al. (2020) stated that the material packaged in an attractive manner would foster motivation that is positively correlated to the formation of conceptual understanding and the achievement of learning success. Lauc, et al. (2020) emphasized that high motivation has a positive effect on better learning outcomes.

All the rubrics presented in the magazine generally had a positive influence on students. All rubrics function to stimulate motivation and interest (Lauc et al., 2020). If students' motivation and interest in learning increase, their learning outcomes also increased (Sari & Darwiyah, 2017). All the rubrics in the magazine also functioned to create a conducive and fun learning environment so that students can study independently (Sari & Darwiyah, 2017; Akbar & Mukminan, 2019) and focused on acquiring knowledge (Akbar & Mukminan, 2019).

BioPhy magazine contained two integrated sciences, namely physics and biology, which made the Floating Market a source of learning, so that it was entitled *BioPhy: Rahasia Indahnya Pasar Terapung* (BioPhy: Secrets of the Beauty of the Floating Market). Physics material related to the Floating Market was fluid, both static fluid and dynamic fluid (Misbah, et al., 2018; Hartini, et al., 2019). The biological material related to the Floating Market as ecotourism is the environment (Normaleni, 2016; Sya'ban, et al., 2017; Stronza, et al., 2019; Wulandari, et al., 2019; Abbas, et al., 2021).

Environmental education listed in the magazine had a specific purpose. The environmental content in this magazine was a form of science as a bridge in building environmental literacy in the community, including students (Turrini, et al., 2018; Boca & Saraçlı, 2019; Ikhsan, et al., 2019) and invited them to participate in protecting the environment and preserving nature (Ballard, et al., 2017; Boca & Saraçlı, 2019) and sensitive to changes and environmental damage (Manase, 2016). In addition, this was an effort to build students' sense of responsibility towards their life environment (Aarnio-Linnanvuori, 2019; Boca & Saraçlı, 2019) and environmental awareness (Manase, 2016; Boca & Saraçlı, 2019). Figure 3 contains a section of the magazine that relates fluid materials and the environment to the Floating Market.

Physics material and biological material associated with the Floating Market make the contents of the magazine contextual. The examples of questions were also contextual. This made students close to the real phenomena around them so that they gain in-depth knowledge (Sulisworo, et al., 2019) and easy to understand the material (Wahyuningsih, et al., 2019). This was also a way to motivate students to study. It was supported by Hammond, et al. (2020) state that motivation arose by giving confidence that the material studied was useful and relevant to his life and presents the material realistically.

The magazine also contained video rubrics related to the Floating Market, physics in particular fluids, biology in particular, the environment. Students could see the video by scanning the QR code listed in the magazine (Sari & Wati, 2020). These vide os

madestudents like magazines so that they were interested in learning and were able to develop their insights and helped understand the material (Jariati & Yenti, 2020).

There were also games in the magazine, such as crossword puzzles, word formation, intelligence quizzes, memory tests, word guesses, character guesses, and species guesses. These games served as a tool to evaluate students' abilities (Sulisworo, et al., 2019), curiosity stimulus (Lauc, et al., 2020), and give feedback on the mastery of the material (Sulisworo, et al., 2019). The variety of games in this magazine could also train critical thinking skills (Sulisworo, et al., 2019). Lauc, et al. (2020) stated that crossword puzzles introduced important and new terms to the material discussed. The quizzes function to stimulate students' motivation and attention (Lauc, et al., 2020).

Pada Pasar Terapung juga berlaku hukum Archimedes. Penerapan hukum ini nampak nyata pada peristiwa mengapungnya jukung di permukaan sungai. Berikut penjelasannya.

Pernahkah kamu memasukkan benda ke dalam air kemudian benda tersebut justru terdorong ke atas permukaan air dan mengapung? Jika pernah, maka kamu telah menyaksikan penerapan hukum Archimedes. Peristiwa tersebut mengindikasikan bahwa terdapat gaya ke atas yang bekerja pada benda ketika benda tersebut berada di dalam air. Gaya ini disebut gaya apung. Gaya apung ini dideskripsikan oleh Archimedes dalam hukumnya yang berbunyi "Gaya apung yang bekerja pada benda yang dimasukkan dalam fluida sama dengan berat fluida yang dipindahkannya". Hukum ini dinyatakan dalam persamaan berikut ini:

$$F_A = \rho_f g V_{\text{sub}}$$

Bio Spot

- > Berbagai sumber makanan banyak ditemukan di dalam ekosistem sungai. Ada jenis tumbuhan dan hewan yang dapat dikonsumsi oleh manusia. Air sungai sendiri merupakan sumber kehidupan yang sangat urgen bagi manusia.
- > Air sungai dapat dijadikan sebagai sumber irigasi.
- > Ekosistem sungai dapat dijadikan salah satu destinasi wisata.
- > Sungai dapat menjadi tempat "penampungan" air sehingga mencegah bencana genangan air.
- > Air sungai berperan serta dalam proses hidrologi.

Nah Sahabat Sains, karena pentingnya manfaat ekosistem sungai dan adanya berbagai kemungkinan penurunan kualitas sungai sebagai dampak pemanfaatannya maka kita juga harus turut serta dalam upaya menjaga kelestariannya. Apa saja yang dapat kita lakukan? *Check it Out!*

1. Stop buang sampah sembarangan ke sungai.
2. Stop penggunaan berbagai jenis obat kimia dalam pencarian ikan di sungai, karena dapat merusak habitat sungai.
3. Menanam pohon-pohon di sekitar sungai.

Figure 3. The Rubric of BioPhy Magazine contains the concepts of physics and biology in the Floating Market (Fitriah & Ita, 2021)

Other rubrics contained simple physics and biology practicums that students could try independently. Each rubric was named *Phylab* and *Biolab*. These two rubrics were useful in strengthening understanding of scientific phenomena (Sulisworo, et al., 2019).

There was also a *My Action* rubric which contained assignments for each student to make a poster with the theme of preserving the river and keeping the river

clean. Yildiz & Budur (2019) supported it, which stated that environmental awareness could be instilled in students through curricular activities, namely making environmental-themed posters.

BioPhy Magazine Validity

Based on the magazine validation sheet given to 12 experts, the magazine's average validity on the content aspect results are as shown in Table 1.

Table 1. Validity of Magazine Content

Sub Component	Item	V	Category
A. Dimensions of Spiritual Attitude	Invitation to live the teachings of Islam	0.92	Valid
	Invitation to practice the teachings of Islam	0.88	Valid
B. Dimensions of Social Attitude	Personal skills	0.75	Valid
	Social skills	0.79	Valid
C. Dimension of Knowledge	Material equipment	0.79	Valid
D. Material Coverage	Material breadth	0.83	Valid
	Material depth	0.81	Valid
E. Material Accuracy	Fact accuracy	0.94	Valid
	Concept/Principle Accuracy/Law/ Theory	0.85	Valid
	Procedure/Method Accuracy	0.90	Valid
F. Recency and Contextual	Conformity with the Development of Science	0.88	Valid
	up-to-date/feature maturity	0.85	Valid
	Real-life	0.90	Valid
G. Compliance with Laws and Legislation	Originality of writing	0.85	Valid
	Free of racist/discrimination/pornography/bias	0.94	Valid
H. Knowledge Integration	Physics is integrated with other sciences	0.90	Valid
I. Material Suitability	Compatibility with education level	0.88	Valid
	Suitability with student abilities	0.85	Valid
	Conformity with the vision and mission	0.92	Valid
J. Skill Dimension	Scope of skills	0.83	Valid
	Activity characteristics	0.81	Valid
	Skills App	0.88	Valid

Table 1 shows that the contents of BioPhy Magazine are valid. This shows that magazine was developed in accordance with the content validity criteria (Linda, et al., 2018; Sulisworo, et al., 2019). This is also a magazine suitable for use in lecture activities (Sari & Darwiyah, 2017; Prasetyana & Corneliawati, 2018; Wahyuningsih, et al., 2019; Sari & Wati, 2020). In addition, this result is meaningful in terms of the contents of the magazine, and the magazine is worthy as a learning medium (Sulisworo, et al., 2019). The results of this validation are similar to the results of the study Jariati & Yenti (2020), Sari & Darwiyah (2017), Wahyuningsih, et al. (2019), Tarawi, et al. (2020), Akbar & Mukminan (2019), and Prasetyana & Corneliawati (2018). They indicate that the magazine has good content validity. Next is the validity of the magazine presentation. The results of this validation are presented in Table 2.

The average validity of the magazine on the presentation aspect was assessed by 12 experts. Table 2 shows that the presentation of BioPhy Magazine is valid. This means that the things presented in the magazine are in accordance with the indicators and objectives of the lecture (Tarawi, et al., 2020) and meet the appropriate validity criteria in terms of presentation aspects (Sulisworo, et al., 2019; Linda, et al., 2018). So, magazines could be used by students.

The validity of this presentation aspect is reasonable because the magazine has been designed in such a way that it could support student learning activities. The magazine size was 21 cm wide and 28 cm high with the appropriate font size so that it could be read well by students. Wahyuningsih, et al. (2019) emphasized that the paper size must be appropriate, and the font size was not too big or too small so that students could easily read it.

The contents of the magazine had also been presented in a coherent and systematic manner. This aimed to avoid confusion for students when understanding the material (Wahyuningsih, et al., 2019). In addition, the contents of the magazine were arranged in order according to the purpose of the lecture. It aims to make it easier for students to achieve these goals (Wahyuningsih, et al., 2019). The contents of the manuscript were also given an appropriate and supportive layout. This made the magazine look dynamic and comfortable to read (Sari & Darwiyah, 2017).

Each magazine page was given an image related to the content of the text discussed and given a colored background display. This made students interested in reading magazines (Sari & Darwiyah, 2017; Zulfarina, Syafii, & Putri, 2021; Wahyuningsih, et al., 2019).

The pictures listed in the magazine created a visual stimulus that provides visual perception and

thinking to help students build understanding and recall experiences (Lauc, et al., 2020). Pictures also made students easily recognized and understood the material (Wahyuningsih, et al., 2019). In addition, the pictures also served to foster motivation to learn (Lauc, et al., 2020) and interest in learning (Sari & Darwiyah, 2017; Sulisworo, et al., 2019) and made the content of

the text more interesting (Prasetyana & Corneliawati, 2018). Learning was fun too (Sari & Darwiyah, 2017; Akbar & Mukminan, 2019). This was the advantage of the magazine, which was that it had visual quality (Sari & Darwiyah, 2017; Wahyuningsih, et al., 2019). So, pictures in magazines are very useful.

Table 2. Validity of Magazine Presentation

Sub Components	Items	V	Category
A. Technique of Presentation	Systematic consistency of serving	0.85	Valid
	Logic of Presentation	0.88	Valid
	Confusion of presentation	0.83	Valid
	Coherence	0.83	Valid
B. Material Presentation Support	The suitability and accuracy of the illustration with the material	0.83	Valid
	Subchapter	0.85	Valid
	Examples of questions	0.83	Valid
	Exercise	0.79	Valid
	Up to date references/reference sources for text, tables, images, and attachments	0.79	Valid
C. Learning Presentation	Answer keys	0.83	Valid
	Active involvement of students	0.85	Valid
	Interactive communication	0.83	Valid
	Variations in presentation	0.90	Valid
	Learning strategies	0.83	Valid
D. Presentation Equipment	Student-centered	0.85	Valid
	Introduction	0.88	Valid
	List of contents	0.88	Valid
	List of natural constants	0.79	Valid
	References	0.92	Valid
E. Format	Paper	0.92	Valid
	Icon	0.88	Valid
	Space	0.88	Valid
	Typing	0.88	Valid
	Layout presentation	0.94	Valid
F. Organization	Order and arrangement of materials	0.81	Valid
	Layout	0.85	Valid
	Organization between sections	0.85	Valid
G. Attractiveness	Color	0.81	Valid
	Paper size	0.85	Valid
	Image/table size	0.83	Valid
	Writing	0.85	Valid
H. Font Shape and Size	Font size and shape	0.81	Valid
	Letter comparison	0.81	Valid
	Capital and lowercase letters	0.83	Valid

The pictures and texts that were presented in a variety of ways made the contents of the magazine easy to understand (Wahyuningsih, et al., 2019; Akbar & Mukminan, 2019; Jariati & Yenti, 2020) and made students feel relaxed and not bored when reading it (Akbar & Mukminan, 2019; Jariati & Yenti, 2020) and overcame student boredom (Sari & Darwiyah, 2017). As a result, learning outcomes could be better (Wahyuningsih, et al., 2019). Thus, the contents of the magazine were relevant to the needs of students.

Pictures and words combined simultaneously in magazines improved the ability to build relationships between verbal and visual information and made it

easier for them to obtain meaningful information (Akbar & Mukminan, 2019). In addition, pictures could help students understand and retain information (Wahyuningsih, et al., 2019). This confirms the reasons why magazines were appropriate for use in the classroom.

Magazines were colorfully designed. This colorful magazine display supported the content of the manuscript, which requires a lot of illustrations (Wahyuningsih, et al., 2019). In addition, the colors in the magazine served to stimulate motivation and build a positive atmosphere and emotions (Lauc, et al., 2020). Colorful magazines could also attract students' interest

in learning and reading (Sari & Darwiyah, 2017; Akbar & Mukminan, 2019). Even the colorful magazines caused students to be able to retain good memories (Singg & Mull, 2017; Wahyuningsih, et al., 2019).

The subsequent validity was the validity of the magazine language. The average validity of the magazine on the language aspect was also assessed by 12 experts. The results of this validation are presented in Table 3.

Table 3 shows that the language aspect of *BioPhy Magazine* was valid. This means that the language used in the magazine complied with the language validity criteria (Sulisworo, et al., 2019). In addition, these results indicated that the use of language in magazines is in accordance with the rules of communicative

Indonesian and easy to understand (Akbar & Mukminan, 2019; Sari & Darwiyah, 2017). So, magazines can be used by students.

The results of this validation also shows that the magazine has been designed in such a way as to suit the characteristics of the magazine. Akbar & Mukminan (2019) stated that the magazine was designed to convey actual information to all readers so that they could understand the contents well so that the magazine was prepared using communicative and simple language. The easy-to-understand language will make the contents of the magazine easy to understand, too (Sari & Darwiyah, 2017; Jariati & Yenti, 2020; Prasetyana & Corneliawati, 2018; Wahyuningsih, et al., 2019).

Table 3. Magazine Language Validity

Subcomponent	Items	V	Categories
A. In accordance with the development of students	Conformity with the level of student thinking development	0.92	Valid
	Compatibility with the level of social/emotional development of students	0.88	Valid
B. Communicative	Students' understanding of the message	0.85	Valid
C. Dialogic and Interactive	Ability to motivate students	0.88	Valid
	Encourage critical thinking in students	0.81	Valid
D. Coherence and Coherence of Thoughts	Links between paragraphs	0.90	Valid
	The integrity of the meaning in the rubric	0.85	Valid
E. Conformity with the Correct Indonesian Rules	Grammatical accuracy	0.83	Valid
	Spelling accuracy	0.81	Not Valid
F. Use of Terms and Symbols/Emblems	Consistency of use of terms	0.81	Valid
	Consistency in the use of symbols/symbols	0.83	Valid
	Accuracy of sentence structure	0.88	Valid
G. straightforward	Term standard	0.85	Valid
	General term	0.92	Valid

Effectiveness of BioPhy Magazine

The effectiveness of the magazine referred to here was the Average Normalized Gain (N-Gain), the Wilcoxon test, and the effect size (d) of the student's answer score on the problem-solving ability after the student used the magazine. Students whose problem-solving abilities were measured were students who were the subject of small group trials. Table 4 shows the data recap of these capabilities.

Table 4 shows that indicator A (ability in each student problem-solving process) with sub-indicators Useful Description (UD), Physics Approach (PA), Specific Application of Physics (SA), Mathematical Procedures (MP), and Logical Progression (LP) has high N-Gain, high effect size, and there is a significant difference between before and after studying with BioPhy Magazine. Likewise, with indicator B (ability in each aspect of problem-solving) with indicators Problem Schema (PS), Analogy (AN), Argument (AG), and Causal (CS) showing similar results. This means that the magazine effectively enhanced problem-solving abilities.

Magazines were able to improve problem-solving skills because it made students learn actively and independently, motivate, and help build understanding (Sari & Wati, 2020). In addition, the magazine was prepared based on local wisdom so that fluid and environmental materials were closely related to students' real lives. Fadli & Irwanto (2020) stated that learning based on local wisdom encouraged students to build meaningful learning experiences. It was also supported by Ilhami, et al. (2018) which state that knowledge was easier to construct if learning was based on local wisdom that students often encounter. Local wisdom-based learning could also increase competence so that it was natural for students to master the teaching material and then applied the knowledge obtained to solve problems (Ramdiah, et al., 2020). Oktavia, et al. (2018) and Putri & Aznam (2019) state that teaching materials containing local wisdom could make learning more exciting and improve thinking skills, further improving problem-solving abilities. Kristanto, et al. (2019) also stated the same thing that teaching materials based on local wisdom had a

positive effect on thinking skills, which then had a good effect on problem-solving abilities.

Table 4. Student Problem Solving Ability

Indicator	Sub-Indicator	N-Gain	d	Asymp. Sig. (2-tailed) Uji Wilcoxon
A	UD	0.92	4.28	0.005
	PA	0.88	4.50	0.005
	SA	0.88	4.49	0.005
	MP	0.89	3.48	0.027
	LP	0.86	4.64	0.005
B	PS	0.88	3.59	0.007
	AN	0.98	4.65	0.005
	AG	0.81	6.30	0.001
	CS	0.88	6.04	0.001
Means Score		0.87	4.55	0.005

Environmental Awareness Campaign

The magazine instills awareness of the river's environment by presenting environmental materials. Next, there was the task of making posters in magazines so that students carried out environmental awareness campaigns, especially about protecting river ecosystems. This campaign was a tangible manifestation of their awareness of the environment so that they were able to invite others to participate in protecting the river environment. Figure 4 shows an example of a poster made by a student.



Figure 4. Examples of environmental-themed posters

The lecturer's assessment of the posters made by students can be seen in Table 5.

Table 5. Assessment of Posters as Media for Environmental Awareness Campaign

Aspects	Criteria	Means
Visible	The image is clearly displayed	96.00
	Appropriate font type and size	96.00
	Layout, background, and image colors match	94.00
Interesting	Attractive poster display	96.00
	Contents and images match	97.00
	Contents of relevant posters for environmental awareness campaign (river)	97.00
Structured	The contents of the poster about the environment are conveyed clearly	95.00
	The message in the poster is emphasized	93.00
	Useful	Readers can understand the information on the poster
Accurate	Complete information about the environment is presented	95.00
	No ambiguous sentences	95.00
Simple	understandable language	95.00
	PUEBI compliant language	95.00
Average		95.38

Based on the data, it is known that the posters made by students were suitable for use as a medium to convey messages. (Ariani, et al., 2019). This shows that students have been able to carry out environmental awareness campaigns well. This poster-making activity was an effort by lecturers to encourage students to give academic voices and helped them develop arguments, especially about the environment (Lynch, 2018). Learning was integrated with environmental education because science learning was relevant to cultivating environmental care and awareness (Ilhami, et al., 2018). Khusniati, et al. (2017) also stated that learning based on local wisdom has proven to instill a caring character for nature conservation.

Students were asked to campaign for the environment by uploading the poster to their respective Instagram accounts. Posters were spread on Instagram because there are many social media users, and it spreads all over the world (Geraldo & Pinto, 2020; Pavelle & Wilkinson, 2020). In addition, with Instagram, users can easily interact and communicate with the broader community (Geraldo & Pinto, 2020; Pavelle & Wilkinson, 2020; Nwachukwu, et al., 2021), and Instagram has an attractive appearance so that it can motivate many people to read the information from the posted images (Pavelle & Wilkinson, 2020).

Conclusion

The results of data analysis show that the magazine has content, presentation, and language validity. Magazines are also effective in improving

problem-solving skills and can instill environmental awareness, as evidenced by the ability of students to campaign for river environmental awareness through posters.

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