

BioPhy magazine based on a floating market for problem-solving skills and environmental awareness

Lutfiyanti Fitriah¹, Ita Ita²

¹Study Program of Physics Education, Faculty of Tarbiyah and Teacher Training, Antasari State Islamic University Banjarmasin, Banjarmasin, Indonesia

²Study Program of Biology Education, Faculty of Tarbiyah and Teacher Training, Antasari State Islamic University Banjarmasin, Banjarmasin, Indonesia

Article Info

Article history:

Received Dec 27, 2021

Revised Aug 29, 2022

Accepted Sep 21, 2022

Keywords:

BioPhy magazine

Environmental awareness

Floating market

Physics

Problem solving

ABSTRACT

This study aimed to describe the validity and effectiveness of the floating market-based BioPhy magazine to improve problem-solving skills and encourage students to conduct environmental awareness campaigns. This research was development research with Tessmer formative evaluation model. The field test subjects were 24 students who studied fluids in the Fundamental Physics Course in the 2021/2022 academic year. Data were obtained through validation sheets and problem-solving questions. Data were analyzed quantitatively and qualitatively. The results showed that the developed magazine was valid and effective in improving students' problem-solving skills with an N-gain score in the field trial of 0.96 with a high category and an effect size of 12.61 with a strong influence category. In addition, based on the different tests, it was known that there is a significant difference between problem-solving abilities before and after learning. The magazine also succeeded in encouraging students to campaign on environmental awareness, as shown in the environmental-themed posters they made and shared on social media. Thus, the developed magazine was valid and effective to improve problem-solving skills and encourage environmental awareness campaigns on fluids in the Fundamental Physics Course.

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Corresponding Author:

Lutfiyanti Fitriah

Study Program of Physics Education, Faculty of Tarbiyah and Teacher Training

Antasari State Islamic University Banjarmasin

A. Yani Street, Banjarmasin, South Kalimantan, Indonesia

Email: lutfiyanti@uin-antasari.ac.id

1. INTRODUCTION

South Kalimantan has unique local wisdom, namely the floating market. This market carries out trading activities on the river [1], [2]. In this market, sellers and buyers ride *Jukung*, which is a traditional means of transportation on the river [3], [4]. Another unique thing is that this market sells various agricultural products, plantations, and swamp fish [5]–[7], culinary [6], [8], and handicrafts typical of South Kalimantan [4], [6]. Even the floating market is nature-based, cultural, culinary, ecotourism, and edutourism [8]. Figure 1 shows the floating market and *Jukung*.

A floating market can be a source of learning physics. This is done by exploring the concepts and principles of the fluid that occurs there [9], [10]. This makes students learn physics as well as local wisdom [9] and make learning physics easy and fun [10].

Floating market as ecotourism can also be a source of learning biology. This market is associated with ecology, biodiversity, nature conservation, nature conservation and environmental awareness [11], [12]. Rivers as a means of trade need to be studied from an environmental perspective so that students realize the importance of preserving and maintaining the cleanliness of the river. This river environmental education needs to be done because community participation in maintaining the river is still low [12], [13]. People still throw garbage and waste in the river so that the river is polluted [14], disturbed river flow and abrasion [15], and decreased river water quality [14], [15]. Students need to be encouraged to maintain river ecosystems, including aquatic vegetation, because both affect the quality and flow of rivers and prevent flooding [16]. Moreover, there is a lot of environmental degradation, so that education needs to participate in discussing environmental issues [17].



Figure 1. Floating market is a market where sellers and buyers ride *Jukung*, a traditional means of transportation on the river

Floating market is used as a source of learning by pouring it into the media of magazines. The magazine is a mass media containing various articles with one particular theme and interesting pictures and designed in an innovative and communicative way [18]-[20]. The characteristics of the magazine are that the language is simple, contains interesting information related to life, contains fun games, and is colorfully designed [21]-[23].

Based on the results of an assessment of students from one of the physics education study programs in South Kalimantan, it is known that they have low fluid problem-solving abilities. This was also found by [24]. This is because they are not able to describe the problem [25], difficult to use mathematical procedures [26], difficult to connect various concepts and information [27], do not master the concept of physics [28], not analyze the problem in depth [29], and students do not study independently [30].

Problem-solving skills need to be improved. This is because good problem-solving skills are one of the objectives of learning physics [29], [30] and the needs of this century [31], [32]. With good problem-solving skills, students are able to face various problems and can think actively, creatively, and carefully [33] and adapt to the era of globalization [30], [34]. Observations also show that lecturers have not provided environmental education. Education needs to instill environmental awareness so that students maintain cleanliness and do not damage the environment [35]. Environmental awareness is influenced by their penchant for science [36]. So, physics material needs to be linked with biological sciences that discuss environmental issues and instill environmental awareness [37], [38].

The concept of physics in the floating market itself has been researched by [9]. In fact, there is a floating market-based physics module [10]. Actually, the development of the magazine has also been carried out by [21], [22], [39]. There have also been many studies on how to improve physics problem-solving skills, including the application of inquiry-based learning with PhET simulation [28], investigation-based-multiple representation (IBMR) learning model [30], problem-based learning that integrates scientific values and

Islamic values (PBL-ISI) [32], and problem based learning [34]. Likewise, with the cultivation of environmental awareness. Various studies have made efforts to inculcate environmental awareness, including the application of environmental education [40], [41]. However, there has been no research on the use of magazines containing physics and biology concepts in an integrated manner based on the floating market to improve problem-solving skills and encourage environmental awareness campaigns. Therefore, this study fills that void. This research is richer than the previous one because the magazine is presented in a varied and interesting manner based on the floating market, contains fluid concepts found in the floating market, contains biological sciences about the environment in the floating market, is published nationally, and is intended for students at the university level. The purpose of this article specifically is to describe the validity and effectiveness of BioPhy magazine in improving problem-solving skills and encouraging environmental awareness campaigns.

2. RESEARCH METHOD

This research was development research which consists of two main stages, namely the preliminary stage and the formative evaluation stage [42]. Table 1 shows the stages of development research in this study. The research was conducted from June to November 2021 at the Tarbiyah and Teacher Training Faculty of State Islamic University (UIN) Antasari Banjarmasin, Indonesia. The subjects of the field trial were 24 students of the Biology Education Study Program who were studying fluids in the Fundamental Physics Course in the 2021/2022 academic year. The research instrument used were a validation sheet [43] and 10 problem-solving questions about four aspects of problem-solving, namely problem schema, analogy, argument, and causal [44], which was then checked using an assessment rubric [45]. The validity of the content, presentation, and language of the magazine was carried out by 12 material experts, 12 media experts, and 12 linguists.

The effectiveness of the magazine was determined by the formula N-Gain [46], Wilcoxon test, and effect size $[d]$ [47] with criteria [48]. The students' environmental awareness campaigns are judged by the posters they made [49]. Poster ratings were based on [50], [51].

Table 1. Research stages

Stages	Activities
Preliminary stage	<ol style="list-style-type: none"> 1. Researchers analyzed the problems of learning physics and its integration with biology learning based on the local wisdom of the floating market. 2. Researchers determined the place, subject, and research schedule. 3. Researchers thought about the initial draft of magazines and instruments and developed them.
Formative evaluation stage	
Self-evaluation	<ol style="list-style-type: none"> 1. Researchers examined various research articles related to the problem. 2. Prepared a list of validator names. 3. Evaluated the initial draft of the product that has been developed and revise the initial draft.
Expert review	<ol style="list-style-type: none"> 1. Validated magazines and research instruments. 2. Revised magazines and instruments based on input from experts [validator team].
One to one test	<ol style="list-style-type: none"> 1. Magazine trialed on 8 students in 1 meeting. 2. Revise the magazine based on the test results.
Small-group test	<ol style="list-style-type: none"> 1. Magazine trialed on 10 students in 5 meetings 2. Revised the magazine based on the test results.
Field test	<ol style="list-style-type: none"> 1. Magazine trialed on 24 students in 5 meetings. 2. Revised the magazine based on the test results and produced a magazine that is ready to be published.

3. RESULTS AND DISCUSSION

3.1. Validity of BioPhy magazine based on floating market

The developed BioPhy magazine was a print media. Magazine was presented in printed form because it was more practical and do not require assistance from other tools to use them [52]. Figure 2 shows the front cover of this magazine. The number of magazine pages was 168. The number of rubrics was 55 with various different topics but still based on the floating market. Based on the magazine validation sheet given to 12 experts, it was obtained as shown in Table 2.

Table 2 shows that the magazine is valid. This shows that the developed magazine met all the validity criteria [23], suitable for use in field tests [22], [52], [53], suitable for use in learning activities [21], [52], [54], worthy of being a learning media [39], the contents of the magazine were clear, complete, and relevant to the competency achievement to be achieved [23], met the appropriate validity criteria in terms of presentation aspects [18], [23], met all validity criteria in terms of language aspects [39], the language in the magazine was in accordance with the rules of good and correct Indonesian, communicative, and easy to understand [39], and in accordance with the character of the student [22], [52].



Figure 2. Front cover of BioPhy [53]

Table 2. Validity of magazines

Component validity	V	Category
Content validity	0.81-0.94	Valid
Construct validity	0.79-0.94	Valid
Language validity	0.81-0.92	Valid

3.2. Effectiveness of BioPhy magazine

Table 3 shows the students' abilities in field trials. This data shows that the problem-solving ability of students has increased. Magazine was effective in improving students' problem-solving skills for several reasons.

Table 3. Students' problem-solving abilities in field tests

Indicator	Sub-indicator	Means of pre-test	Means of post-test	N-Gain	d	Asymp. Sig. [2-tailed] Wilcoxon Test
Ability in every problem-solving process	Useful description	19.25	100.00	1.00	12.14	0.005
	Physics approach	14.25	100.00	1.00	13.79	0.005
	Specific application of physics	12.75	98.25	0.98	13.41	0.005
	Mathematical procedures	6.5	92.25	0.92	11.50	0.000
Ability in every aspect of problem solving	Logical progression	12.75	92.25	0.91	9.74	0.005
	Problem schema	10.75	95.50	0.95	10.86	0.008
	Analogy	9.25	100.00	1.00	20.90	0.005
	Argument	16.75	96.25	0.95	9.47	0.001
	Causal	18.00	96.25	0.95	10.40	0.001
	Average score	14.50	96.75	0.96	12.61	0.000

First, magazine helped students understand the material, fostered motivation, and made learning student-centered and strengthen memory [55] so that they successfully solved the problem [56], [57]. Second, the pictures presented in the magazine helped students to learn and understand the material and built meaning

[58]. Third, the magazine was designed to be colorful to attract students' interest [52]. If students are happy, they will be happy to solve problems [59] so that they try to solve problem solving problems well and tend to be successful in solving them [57]. Fourth, the magazine contained cognitive scaffolding, such as tables and graphs, to help students understand the material and solve problems [60]. Fifth, local wisdom, which was a source of student learning, made it easy for them to learn, attracted attention, and helped them to understand concepts [38], [61] and provided opportunities to construct meaningful learning experiences. In addition, local wisdom in magazine made the material relevant to life, made it easier for them to understand and solve problems [59]. Sixth, students were given the opportunity to solve problem-solving problems listed in BioPhy magazine in groups that made students interact socially with each other so that they were able to construct their own understanding according to Vygotsky's social constructivist learning approach [62], [63]. Group work facilitated students sharing ways to solve problems [62], [64] and reduced complexity in solving problems [62], [65]. Seventh, the problem-solving questions in the magazine were contextual in nature which stimulated students to actively explore and connected knowledge with various events in life so that students' solving abilities increase [66]. The questions in the magazine were also presented in the form of games that caused positive emotions, enjoy learning, do not get bored, and were motivated so that academic achievement increased [65].

3.3. Environmental awareness campaign

The encouragement to carry out an environmental awareness campaign was carried out by including the task of making a poster in BioPhy magazine after the material on the river environment was presented in the magazine. Making this poster was an indicator that students had environmental awareness after studying with BioPhy magazine, as evidenced by their encouragement to carry out campaigns. Thus, the magazine not only provided an understanding of the importance of the river environment, but also made students participate in real environmental awareness campaigns. The content of the poster itself was an appeal to the public to preserve and maintained the cleanliness of the river. An example of this poster is shown in Figure 3.

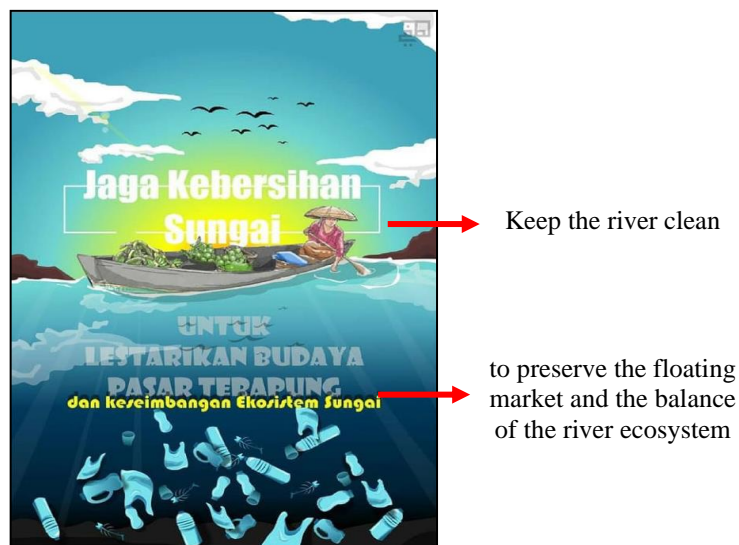


Figure 3. Example of a poster for an environmental awareness campaign

The poster was then distributed by students to the public on their respective Instagram accounts. The assessment of poster can be seen in Table 4. Posters of students judged by two lecturers. The validity of the assessment is calculated by product moment correlation with rough numbers [67]. Based on the calculation, it is known that the validity coefficient was 0.77, which means the results of both assessments were valid. As for the reliability of the assessment was determined based on the percentage of agreement [68]. Based on the calculation, it is known that the reliability percentage of agreement was 95%, which means the results of both assessments were reliable.

Table 4. Assessment of posters as media for environmental awareness campaigns in field tests

Aspect	Criteria	Means
Visible	Image display clarity	96
	Appropriateness of font size and type	97
Interesting	Image color compatibility, image layout, and background (background)	95
	The attractiveness of the image displayed on the poster	96
	The suitability of the image with the material on the poster	97
Structured	The suitability of the poster content with the objectives of the environmental awareness campaign	97
	Clarity of the material contained in the poster about the environment	95
Useful	Emphasis of message in the poster	94
	The information in the poster can be conveyed to the reader	96
Accurate	Completeness of presentation of information about the environment	96
Simple	The use of sentences does not lead to multiple interpretations and misunderstandings	95
	Use of language that is easy to understand	96
	The use of language on the poster is in accordance with the general guidelines for Indonesian spelling (PUEBI) rules	95
	Average of scores	95.77
	Validity coefficient r_{xy}	0.77
	The reliability percentage of agreement	95%

Based on Table 4 it is known that poster were suitable to be used as a medium to convey messages to the public and met the criteria as poster, namely combining visual aspects, colors, and messages so that it could attract the attention of many people [51]. In addition, this means that the poster was attractive, easy to understand, could be a medium of communication, and the content of the message was useful for readers [69]. So, the posters that have been prepared were good as media for environmental awareness campaigns.

One of the environmental education strategies is to combine the material being taught with various learning activities [41], [70]. The task of making posters in BioPhy magazine was an effort to instill environmental awareness and encouraged participation in environmental campaigns. This poster was also a source of information for other students about the environment so that it could increase environmental awareness [40]. So, this activity was part of environmental education. Environmental education was proven to increase students' understanding of environmental problems and increased environmental care attitudes [71].

Students were asked to share posters on Instagram. Instagram was used as a medium for delivering information because it is used by many people around the world [72], users are easy to interact and communicate [72], [73], users easily post interesting pictures to influence people [72], [73], and have visual appeal [73]. Instagram is a very powerful tool to attract people's attention to pay attention to the content of messages shared on the media [74]. The results also showed that Instagram was proven to increase environmental awareness so that it was effectively used as a media for environmental campaigns [72], [73], [75], [76].

4. CONCLUSION

The floating market-based BioPhy magazine was valid to be used as a medium for fundamental physics lectures on fluids. In addition, magazine was effectively used to improve problem-solving skills and encourage students to campaign on environmental awareness. For further research, it is possible to develop similar magazines based on other local wisdom for various physics teaching materials in universities.

ACKNOWLEDGEMENTS

The research team would like to thank the Institute for Research and Community Service Antasari State Islamic University Banjarmasin Indonesia, which has provided research funding assistance in the 2021 fiscal year.

REFERENCES

- [1] M. Arif Budiman, "Opportunity and threat of developing halal tourism destinations: A case of Banjarmasin, Indonesia," *International Journal of Economic Behavior and Organization*, vol. 7, no. 1, p. 7, 2019, doi: 10.11648/j.ijebo.20190701.12.
- [2] P. Angriani, Sumarmi, I. N. Ruja, and S. Bachri, "River management: The importance of the roles of the public sector and community in river preservation in Banjarmasin (A case study of the Kuin River, Banjarmasin, South Kalimantan – Indonesia)," *Sustainable Cities and Society*, vol. 43, pp. 11–20, 2018, doi: 10.1016/j.scs.2018.08.004.
- [3] M. Fathoni, P. Pradono, I. Syabri, and Y. R. Shanty, "Analysis to assess potential rivers for cargo transport in Indonesia," *Transportation Research Procedia*, vol. 25, pp. 4544–4559, 2017, doi: 10.1016/j.trpro.2017.05.351.
- [4] E. W. Abbas, Mutiani, M. R. N. Handy, R. M. Shaleh, and N. T. F. W. Hadi, "Lok Baintan Floating Market: The ecotourism




- potential of rural communities,” in *Proceedings of the 2nd International Conference on Social Sciences Education (ICSSE 2020)*, 2021, vol. 525, no. 525, pp. 368–371, doi: 10.2991/assehr.k.210222.060.
- [5] D. Arisanty, E. Normelani, H. P. N. Putro, and M. Z. A. Anis, “The role of women in Lok Baintan floating market, South Kalimantan: Implication for tourism development,” *Journal of Indonesian Tourism and Development Studies*, vol. 5, no. 3, pp. 169–174, Sep. 2017, doi: 10.21776/ub.jitode.2017.005.03.05.
- [6] D. Arisanty, E. Normelani, H. P. N. Putro, and M. Z. A. Anis, “The role of local government for local product processing: the Implication for tourism sustainability in Lok Baintan floating market,” *Journal of Indonesian Tourism and Development Studies*, vol. 7, no. 1, pp. 7–12, 2019, doi: 10.21776/ub.jitode.2019.07.01.01.
- [7] D. Arisanty, H. P. N. Putro, E. Normelani, and M. Z. A. Anis, “Women traders livelihoods in tourism area of Lok Baintan floating market,” *Journal of Indonesian Tourism and Development Studies*, vol. 8, no. 1, pp. 25–32, 2020, doi: 10.21776/ub.jitode.2020.008.01.04.
- [8] E. Normelani, “The floating market of Lok Baitan, South Kalimantan,” *Journal of Indonesian Tourism and Development Studies*, vol. 4, no. 1, pp. 1–4, 2016, doi: 10.21776/ub.jitode.2016.004.01.01.
- [9] Misbah, D. Dewantara, and S. Mahtari, “Physics learning based on Wetlands and Banjar culture,” *International Journal of Applied and Physical Sciences*, vol. 4, no. 1, pp. 21–28, Mar. 2018, doi: 10.20469/ijaps.4.50004-1.
- [10] S. Hartini, L. Prahesti, D. Dewantara, and S. Annur, “Developing of physics learning material based on floating market local wisdom,” *International Journal of Recent Technology and Engineering (IJRTE)*, vol. 7, no. 6, pp. 738–743, 2019.
- [11] M. F. Sya’ban, A. Sholahuddin, S. An’nur, and M. K. Riefani, “Potential Wetland screening in Barito Kuala and Banjarmasin as Source of science learning,” *Advances in Social Science, Education and Humanities Research*, vol. 100, pp. 295–297, 2017, doi: 10.2991/seadric-17.2017.62.
- [12] A. L. Stronza, C. A. Hunt, and L. A. Fitzgerald, “Ecotourism for conservation?,” *Routledge Handbook of Ecotourism*, vol. 44, pp. 372–397, 2022, doi: 10.4324/9781003001768-28.
- [13] H. Matnuh, R. Adawiah, and A. P. Putra, “Problemate river management in the city a thousand river,” *Psychology and Education*, vol. 58, no. 2, pp. 9752–9762, 2021, doi: 10.17762/pae.v58i2.3830.
- [14] N. F. Sulaeman, A. Nuryadin, R. Widyastuti, and L. Subagiyo, “Air quality index and the urgency of environmental education in Kalimantan,” *Jurnal Pendidikan IPA Indonesia*, vol. 9, no. 3, pp. 371–383, 2020, doi: 10.15294/jpii.v9i3.24049.
- [15] T. Kurniawan, M. Bisri, P. T. Juwono, and E. Suhartanto, “Review of the natural phenomenon and human intervention that affect the condition of river performance and infrastructure,” *Journal of Southwest Jiaotong University*, vol. 56, no. 4, pp. 7–15, 2021, doi: 10.35741/issn.0258-2724.56.4.2.
- [16] P. M. Rowiński, K. Västilä, J. Aberle, J. Järvelä, and M. B. Kalinowska, “How vegetation can aid in coping with river management challenges: A brief review,” *Ecohydrology and Hydrobiology*, vol. 18, no. 4, pp. 345–354, 2018, doi: 10.1016/j.ecohyd.2018.07.003.
- [17] Ridhwan, Sumarmi, I. N. Ruja, D. H. Utomo, and R. M. Sari, “Measuring students environmental problem solving ability across gender and school differences using paper based testing,” *International Journal of Emerging Technologies in Learning*, vol. 15, no. 13, pp. 303–320, 2020, doi: 10.3991/ijet.v15i13.11709.
- [18] R. Linda, H. Herdini, I. S. S., and T. P. Putra, “Interactive e-module development through chemistry magazine on Kvisoft flipbook maker application for chemistry learning in second semester at second grade senior high school,” *Journal of Science Learning*, vol. 2, no. 1, p. 21, 2018, doi: 10.17509/jsl.v2i1.12933.
- [19] S. D. Prasetyana and E. Corneliawati, “Development of histology teaching materials of five human organs magazine based on Corel Draw for student at IKIP Budi Utomo Malang,” *Bioedukasi*, vol. 16, no. 2, p. 99, 2018, doi: 10.19184/bioedu.v16i2.9475.
- [20] E. Jariati and E. Yenti, “Development of E-magazine based on multiple representations for chemistry learning in senior high school on electrolyte and non-electrolyte solution materials (in Indonesian),” *Journal of Natural Science and Integration*, vol. 3, no. 2, p. 138, 2020, doi: 10.24014/jnsi.v3i2.10131.
- [21] R. Wahyuningsih, S. Sukaesih, and E. Peniati, “Development of biomagz based on local wisdom on biodiversity material in high school,” *Journal of Biology Education*, vol. 8, no. 2, pp. 246–256, 2019, doi: 10.15294/jbe.v8i2.27302.
- [22] R. Akbar and Mukminan, “Biology e-magazine development in human respiratory system topic for grade VIII of junior high school,” *Journal of Physics: Conference Series*, vol. 1233, no. 1, pp. 1–11, 2019, doi: 10.1088/1742-6596/1233/1/012010.
- [23] O. Tarawi, A. M. Noer, and R. Linda, “The development of acid-base e-chemistry magazine as interactive teaching materials,” *Journal of Physics: Conference Series*, vol. 1440, no. 1, pp. 1–8, 2020, doi: 10.1088/1742-6596/1440/1/012012.
- [24] A. Pahrudin, S. Syafril, R. Zahro, A. Handoko, N. E. Yaumas, and Z. H. Iksan, “Development of islamic value-based picture in biology learning with the ISI-ARE model,” *Tadris: Jurnal Keguruan dan Ilmu Tarbiyah*, vol. 4, no. 2, pp. 237–246, 2019, doi: 10.24042/tadris.v4i2.4668.
- [25] A. Halim, Yusrizal, Susanna, and Tarmizi, “An analysis of students’ skill in applying the problem solving strategy to the physics problem settlement in facing AEC as global competition,” *Jurnal Pendidikan IPA Indonesia*, vol. 5, no. 1, pp. 1–5, 2016, doi: 10.15294/jpii.v5i1.5782.
- [26] L. Bollen, P. Van Kampen, C. Baily, M. Kelly, and M. De Cock, “Student difficulties regarding symbolic and graphical representations of vector fields,” *Physical Review Physics Education Research*, vol. 13, no. 2, pp. 1–17, 2017, doi: 10.1103/PhysRevPhysEducRes.13.020109.
- [27] E. Ince, “An overview of problem solving studies in physics education,” *Journal of Education and Learning*, vol. 7, no. 4, p. 191, 2018, doi: 10.5539/jel.v7n4p191.
- [28] L. Yuliati, C. Riantoni, and N. Mufti, “Problem solving skills on direct current electricity through inquiry-based learning with PhET simulations,” *International Journal of Instruction*, vol. 11, no. 4, pp. 123–138, 2018, doi: 10.12973/iji.2018.1149a.
- [29] A. Shishigu, A. Hailu, and Z. Anibo, “Problem-based learning and conceptual understanding of college female students in physics,” *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 14, no. 1, pp. 145–154, 2018, doi: 10.12973/ejmste/78035.
- [30] D. A. Setyarini, Z. A. Imam Supardi, and Elok Sudibybo, “Improving senior high school students’ physics problem-solving skills through investigated based multiple representation (IBMR) learning model,” *IJORER: International Journal of Recent Educational Research*, vol. 2, no. 1, pp. 42–53, 2021, doi: 10.46245/ijorer.v2i1.74.
- [31] L. Bao and K. Koenig, “Physics education research for 21st century learning,” *Disciplinary and Interdisciplinary Science Education Research*, vol. 1, no. 1, pp. 1–12, 2019, doi: 10.1186/s43031-019-0007-8.
- [32] K. Shukri, M. Teh, E. F. Fahyuni, and H. E. Rudyanto, “A new model oriented on the values of science, islamic, and problem-solving in elementary schools,” *Psychology and Education*, vol. 58, no. 2, pp. 2668–2679, 2021.
- [33] R. B. Rudibyani, R. Perdana, and E. Elisanti, “Development of problem-solving-based knowledge assessment instrument in electrochemistry,” *International Journal of Instruction*, vol. 13, no. 4, pp. 957–974, 2020, doi: 10.29333/iji.2020.13458a.
- [34] J. Maknun, “Physics problem solving skills of civil engineering students by implementing problem-based learning,” *Review of*

- International Geographical Education Online*, vol. 11, no. 3, pp. 594–603, 2021, doi: 10.33403/rigeo.800525.
- [35] R. Adawiah, “Instilling the environmental care characters to the elementary schools located on the river banks,” *Journal of Wetlands Environmental Management*, vol. 6, no. 2, p. 84, 2019, doi: 10.20527/jwem.v6i2.177.
- [36] P. Susongko and T. Afrizal, “The determinant factors analysis of Indonesian students’ environmental awareness in pisa 2015,” *Journal Pendidikan IPA Indonesia*, vol. 7, no. 4, pp. 407–419, 2018, doi: 10.15294/jpii.v7i4.10684.
- [37] T. L. Fleischner *et al.*, “Teaching biology in the field: Importance, challenges, and solutions,” *BioScience*, vol. 67, no. 6, pp. 558–567, 2017, doi: 10.1093/biosci/bix036.
- [38] S. Ramdiah, A. Abidinsyah, M. Royani, H. Husamah, and A. Fauzi, “South Kalimantan local wisdom-based biology learning model,” *European Journal of Educational Research*, vol. 9, no. 2, pp. 639–653, 2020, doi: 10.12973/eu-jer.9.2.639.
- [39] D. Sulisworo, A. Ristiani, and D. A. Kusumaningtyas, “Developing the physics magazine as an alternative of personal learning media,” *Journal of Physics: Conference Series*, vol. 1280, no. 5, pp. 1–7, 2019, doi: 10.1088/1742-6596/1280/5/052015.
- [40] Y. Yildiz and T. Budur, “Introducing environmental awareness to college students with curricular and extracurricular activities,” *International Journal of Academic Research in Business and Social Sciences*, vol. 9, no. 3, pp. 666–675, 2019, doi: 10.6007/ijarbs/v9-i3/5734.
- [41] A. Sholahuddin, R. Fitriyana, M. F. Sya’ban, and I. K. Sadiqin, “Students’ caring attitudes to wetland environment: A case of environmental education in Banjar district Indonesia,” *Jurnal Pendidikan IPA Indonesia*, vol. 10, no. 1, pp. 149–158, 2021, doi: 10.15294/jpii.v10i1.27838.
- [42] M. Tessmer, *Planning and Conducting Formative Evaluations*. London: Taylor & Francis Group, 2013.
- [43] National Education Standards Agency, *Elementary school textbook assessment instrument (in Indonesian)*. Jakarta: Badan Standar Nasional Pendidikan, National Education Standards Agency, 2012.
- [44] D. Jonassen, “Supporting problem solving in PBL,” *Interdisciplinary Journal of Problem-Based Learning*, vol. 5, no. 2, pp. 9–27, 2011, doi: 10.7771/1541-5015.1256.
- [45] J. L. Docktor *et al.*, “Assessing student written problem solutions: A problem-solving rubric with application to introductory physics,” *Physical Review Physics Education Research*, vol. 12, no. 1, pp. 1–18, 2016, doi: 10.1103/PhysRevPhysEducRes.12.010130.
- [46] R. R. Hake, “Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses,” *American Journal of Physics*, vol. 66, no. 1, pp. 64–74, 1998, doi: 10.1119/1.18809.
- [47] G. a Morgan, N. L. Leech, G. W. Gloeckner, and K. C. Barrett, *SPSS for Introductory Statistics: Use and Interpretation*, vol. 1. New Jersey: Lawrence Erlbaum Associates Incan, 2004.
- [48] L. Cohen, L. Manion, and K. Morrison, *Research Methods in Education*, Six editio. Newyork: Taylor & Francis, 2017.
- [49] M. Wallengren Lynch, “Using conferences poster presentations as a tool for student learning and development,” *Innovations in Education and Teaching International*, vol. 55, no. 6, pp. 633–639, 2018, doi: 10.1080/14703297.2017.1286999.
- [50] G. R. Hess and E. N. Brooks, “The class poster conference as a teaching tool,” *Journal of Natural Resources and Life Sciences Education*, vol. 27, no. 1, pp. 155–158, 1998, doi: 10.2134/jnrlse.1998.0155.
- [51] E. S. Ariani, S. Syamswisna, and T. Titin, “The feasibility of folding posters for sub-materials on the use of biodiversity in Indonesia (in Indonesian),” *Journal of Biology Learning*, vol. 1, no. 2, pp. 78–87, 2019, doi: 10.32585/v1i2.392.
- [52] S. Adelila Sari and T. Darwiyah, “Innovative magazine development on petroleum materials for senior high school,” *Advances in Social Science, Education and Humanities Research*, vol. 104, pp. 286–291, 2017, doi: 10.2991/aisteel-17.2017.59.
- [53] K. Komarudin, S. Suherman, L. Puspita, and I. A. Savitri, “Electronic magazine development in mathematics learning,” *JTAM (Jurnal Teori dan Aplikasi Matematika)*, vol. 4, no. 2, p. 97, 2020, doi: 10.31764/jtam.v4i2.1947.
- [54] A. S. Sari and I. W. K. Wati, “Visibility of learning media of a culinary-based electronic magazine in blended learning,” *Jurnal Pendidikan Teknologi dan Kejuruan*, vol. 26, no. 1, pp. 35–42, 2020, doi: 10.21831/jptk.v26i1.28018.
- [55] L. Fitriah and Ita, *BioPhy: Rahasia indahnya pasar terapung*. Kabupaten Banjar: Ruang Karya Bersama, 2021.
- [56] A. Karakolidis, V. Pitsia, and A. Emvalotis, “The case of high motivation and low achievement in science: what is the role of students’ epistemic beliefs?,” *International Journal of Science Education*, vol. 41, no. 11, pp. 1457–1474, 2019, doi: 10.1080/09500693.2019.1612121.
- [57] S. Lee, Y. il Choi, and S. W. Kim, “Roles of emotions induced by immediate feedback in a physics problem-solving activity,” *International Journal of Science Education*, vol. 43, no. 10, pp. 1525–1553, 2021, doi: 10.1080/09500693.2021.1922778.
- [58] M. Peterson, C. Delgado, K. S. Tang, C. Bordas, and K. Norville, “A taxonomy of cognitive image functions for science curriculum materials: identifying and creating ‘performative’ visual displays,” *International Journal of Science Education*, vol. 43, no. 2, pp. 314–343, 2021, doi: 10.1080/09500693.2020.1868609.
- [59] J. Massolt and A. Borowski, “Perceived relevance of university physics problems by pre-service physics teachers: personal constructs,” *International Journal of Science Education*, vol. 42, no. 2, pp. 167–189, Jan. 2020, doi: 10.1080/09500693.2019.1705424.
- [60] S. P. Rojas Rojas, A. Meneses, and E. Sánchez Miguel, “Teachers’ scaffolding science reading comprehension in low-income schools: how to improve achievement in science,” *International Journal of Science Education*, vol. 41, no. 13, pp. 1827–1847, 2019, doi: 10.1080/09500693.2019.1641855.
- [61] S. Uge, A. Neolaka, and M. Yasin, “Development of social studies learning model based on local wisdom in improving students’ knowledge and social attitude,” *International Journal of Instruction*, vol. 12, no. 3, pp. 375–388, 2019, doi: 10.29333/iji.2019.12323a.
- [62] A. C. Gonzales, S. Purington, J. Robinson, and M. Nieswandt, “Teacher interactions and effects on group triple problem solving space,” *International Journal of Science Education*, vol. 41, no. 13, pp. 1744–1763, 2019, doi: 10.1080/09500693.2019.1638982.
- [63] A. Fadli and Irwanto, “The effect of local wisdom-based ELSII learning model on the problem solving and communication skills of pre-service islamic teachers,” *International Journal of Instruction*, vol. 13, no. 1, pp. 731–746, 2020, doi: 10.29333/iji.2020.13147a.
- [64] I. N. Dewi, B. M. Harisanti, and S. Sumarjan, “Integration of local wisdom through Enculturation-Assimilation-Acculturation (EAA): A solution to enhance problem-solving skills,” *JPBI (Jurnal Pendidikan Biologi Indonesia)*, vol. 7, no. 3, pp. 231–239, 2021, doi: 10.22219/jpbi.v7i3.13385.
- [65] S. Chen, S. Jamiatul Husnaini, and J. J. Chen, “Effects of games on students’ emotions of learning science and achievement in chemistry,” *International Journal of Science Education*, vol. 42, no. 13, pp. 2224–2245, 2020, doi: 10.1080/09500693.2020.1817607.
- [66] Yuberti, S. Latifah, A. Anugrah, A. Saregar, Misbah, and K. Jermstittiparsert, “Approaching problem-solving skills of momentum and impulse phenomena using context and problem-based learning,” *European Journal of Educational Research*, vol. 8, no. 4, pp. 1217–1227, 2019, doi: 10.12973/eu-jer.8.4.1217.




- [67] M. Mayarni and Y. Yulianti, "The relationship between critical thinking skills and students' creative thinking skills on ecological material (in Indonesian)," *PENDIPA Journal of Science Education*, vol. 4, no. 3, pp. 39–45, 2020, doi: 10.33369/pendipa.4.3.39-45.
- [68] Asri, R. Junaid, and S. Saputra, "The development of learning model through video documentary to improve environmental knowledge of coastal residents of Palopo City, Indonesia," *Jurnal Pendidikan IPA Indonesia*, vol. 9, no. 3, pp. 396–407, 2020, doi: 10.15294/jpii.v9i3.23358.
- [69] E. J. Wicaksana, P. Atmadja, and Y. Asmira, "Development of character education-based reproductive health posters using Canva at school age teenagers in high school (in Indonesian)," *Jurnal Penelitian dan Pengkajian Ilmu Pendidikan: e-Saintika*, vol. 4, no. 2, p. 160, 2020, doi: 10.36312/e-saintika.v4i2.215.
- [70] Siswanto, Karimullah, R. Prasetyawati, and Nurhayati, "Environmental cultured education and its implication on the student's competencies in an adiwiyata school," *Cakrawala Pendidikan*, vol. 38, no. 3, pp. 552–564, 2019, doi: 10.21831/cp.v38i3.23154.
- [71] D. Saribas, Z. D. Kucuk, and H. Ertepinar, "Implementation of an environmental education course to improve pre-service elementary teachers' environmental literacy and self-efficacy beliefs," *International Research in Geographical and Environmental Education*, vol. 26, no. 4, pp. 311–326, 2017, doi: 10.1080/10382046.2016.1262512.
- [72] R. U. Nwachukwu, M. U. Agboeze, C. M. Ugwunnadi, and M. O. Ugwueze, "Social media: An adult education approach for improving the environmental awareness of timber merchants in Udenu, Enugu State," *IOP Conference Series: Earth and Environmental Science*, vol. 730, no. 1, pp. 1–7, 2021, doi: 10.1088/1755-1315/730/1/012022.
- [73] S. Pavelle and C. Wilkinson, "Into the digital wild: Utilizing Twitter, Instagram, YouTube, and Facebook for effective science and environmental communication," *Frontiers in Communication*, vol. 5, pp. 1–8, 2020, doi: 10.3389/fcomm.2020.575122.
- [74] A. Kaur and H. S. Chahal, "Raising environmental awareness among young generation using social media: A case 'Green It at Ishik University,'" *Researchers World: Journal of Arts, Science and Commerce*, vol. 9, no. 1, p. 19, 2018, doi: 10.18843/rwjasc/v9i1/03.
- [75] M. Ozdemir and R. Alkabbanie, "Raising Environmental Awareness among Young Generation Using Social Media: A Case 'Green It at Ishik University,'" *Eurasian Journal of Science and Engineering*, vol. 2, no. 2, pp. 68–79, 2017, doi: 10.23918/eajse.v2i2p68.
- [76] S. Hamid, M. T. Ijab, H. Sulaiman, R. Md. Anwar, and A. A. Norman, "Social media for environmental sustainability awareness in higher education," *International Journal of Sustainability in Higher Education*, vol. 18, no. 4, pp. 474–491, 2017, doi: 10.1108/IJSHE-01-2015-0010.

BIOGRAPHIES OF AUTHORS



Lutfiyanti Fitriah    is a lecturer at Study Program of Physics Education Faculty of Tarbiyah and Teacher Training, Antasari State Islamic University Banjarmasin, South Kalimantan, Indonesia. She teaches courses on Fundamental Physics, Mechanics, Environmental Physics, Ethnoscience, Evaluation of Learning, and Innovation of Learning. The research focuses are physics learning, ethnoscience, ethnopedagogy, teaching and learning strategy. She got first place in 2020 in the national level non-fiction book writing competition held by Ruang Karya Publisher and the first best author in the 2020 non-fiction book category at the Ruang Karya Publisher Award event. She was also awarded as the first best researcher on a research grant at Antasari State Islamic University Banjarmasin in 2021. She is currently the head of the Study Program of Physics Education Faculty of Tarbiyah and Teacher Training. She is also the administrator of local wisdom and wetlands field at Physical Society of Indonesia in South Kalimantan. In addition to 23 journal articles, she has published two magazine articles, three articles in mass media, one reference book, two monograph book, five textbooks, two modules, four book chapters, and one student worksheet. She has been a speaker at various seminars and workshops 42 times. She has directed five projects funded by Antasari State Islamic University Banjarmasin. She can be contacted at email: lutfiyanti@uin-antasari.ac.id.



Ita    is a lecturer at Biology Education Department in Faculty of Education and Teacher Training UIN Antasari Banjarmasin Indonesia. Ita received her master degree in Biology Education from Universitas Lambung Mangkurat (ULM) Indonesia. She has held administrative posts as Secretary of Biology Education Department for four years between 2018-2021. And then continue for the same position in 2021-2025. She conducts research on biology education, design biology learning or biology learning based local wisdom. She has written several articles, books, and book chapters related to the research. She is involved as an editor and reviewer in several national journals. She is also actively involved in national and international seminars to disseminate the results of her research in the field of biology learning. Besides being active in teaching and researching, he also participates in community service programs with a scientific basis for biology education. She can be contacted at email: ita@uin-antasari.ac.id.