

Development of Popular Urban Edutours Books to Improve Cognitive Skills of High School StudentsMuhammad Zaini ^[1], Sri Amintarti ^[1], Rizqa Mardhatilah ^{[2]*}^[1]Lecturer in the Biology Education Study Program, Faculty of Teacher Training and Education, Lambung Mangkurat University Jl. Brigadier General H. Hasan Basry, Banjarmasin 70123, South Kalimantan, Indonesia^[2]Biology Education Student, Indonesia

Abstract. This development research aims to evaluate the validity, practicality, and effectiveness of the popular Urban Edutours book to improve the cognitive skills of high school students. Research using Tessmer's formative evaluation design consisted of four steps; the first three steps were used in this study, namely expert tests, individual tests, and small group tests. The object of research is popular urban edutourism books. The subjects of the expert test research were UMM Palangkaraya Biology Education Lecturers, UIN Antasari Banjarmasin Lecturers and Teachers at SMAN 4 Banjarbaru. Individual tests and small group tests are students of SMAN 4 Banjarbaru. The research uses instruments to test the validity, practicality of the content, practicality of expectations, and effectiveness of expectations. Data analysis was carried out descriptively. The results of the study show that the popular Urban Edutourism book is in the valid category, as well as the good category of LKPD. The practicality of the content (readability of the book) is in the good category, so is the LKPD. The practicality of expectations is in the good category and the effectiveness of the expectations is also in the good category.

Keywords: development research, urban educative tourism popular books, quality

Preliminary

21st century skills arise because of the reality of global education that has not fully matched the needs of educational output in the digital era. The context of learning in this century requires students to learn through examples, applications, and real-world experiences. In order for demands to be implemented, it is necessary to involve the use of Information and Computer Technology (ICT) in an appropriate, sustainable and affordable manner (Rahayu et al., 2022).

The learning paradigm is generally for competition. Without realizing it, educators teach and educate that they like to compete but forget to work together (Prayogi, 2020). Therefore, students need 21st century skills, namely critical thinking, collaboration, creativity, and communication.

Khoirunnisa and Habibah (2019) state that developments in the 21st century have had a negative impact on society and the environment. The information that spread around the world went out of control and caused a high digital boom. Putriani and Hudaidah (2021) stated that the industrial revolution was one of the major changes in the field of technology which resulted in changes in other fields, especially in the educational and social fields.

The State of Japan declared Society 5.0. This concept allows each individual to take advantage of modern science-based knowledge such as the Internet of Things (IoT) or Artificial Intelligence (AI) which will later meet human needs to live comfortably. Aripin et al. (2020) explained that the development of ICT has made the world smaller, various information from various corners of the world can be accessed quickly by anyone and from anywhere, as well as interpersonal communication.

* Corresponding Author

Dahi et al. (2020) explains that in the ICT era, teachers deal with students who are born and develop in the digital era. Teachers must have high technological literacy so that they need to be equipped with ICT. That is to be skilled at using ICT as part of the learning process.

According to Rahayu et al. (2022), the use of ICT in an appropriate, sustainable and affordable manner requires cognitive skills in the context of life regarding a problem, event or event. The National Research Council (2008) focuses on three skills namely 1) cognitive skills (non-routine problem solving, critical thinking, systems thinking), 2) interpersonal skills (complex communication, social skills, teamwork, cultural sensitivity, diversity), 3) intrapersonal skills (self-management, time management, self-development, self-regulation, adaptability, and executive function).

Efforts to improve the quality of several aspects of life, both educational and social, have been initiated in this country. This is demonstrated by the implementation of the Freedom to Learn curriculum initiated by the Minister of Education, Culture, Research and Technology of the Republic of Indonesia. The main concept of independent learning is freedom in thinking. Marisa (2021) explained that curriculum development is one of the steps to shape the character of students in facing this era.

This curriculum was developed with the hope of creating a millennial generation that is able to understand knowledge quickly, not just being good at remembering the teaching materials provided. Students are also expected to be able to utilize technology in their learning process, which previously relied on textual books, but now digital products such as e-books are starting to be replaced (Indarta et al., 2021).

Learning models that can be used to trigger the emergence of 21st century skills are Problem Based Learning (PBL) and Project Based Learning (PjBL) learning models. This model is covered by constructivist learning theory and can develop students' critical thinking skills (HOTS). Through the PBL model students become active in thinking, communicating, searching for and processing data, and finally making conclusions (Astuti, 2019).

Biology learning is related to content (material) and process. Even though the learning experience explores content, in the implementation of learning through observation, it is said that learning biology is rich in processes. Project-based learning is a mainstay of developing guiding questions (a question).

Considering that students have different learning styles, project-based learning provides opportunities for students to explore content using a variety of meaningful ways. This allows students to be able to answer guiding questions (Nirwana, 2019).

Facione (1990) explains that there are six indicators of critical thinking skills, namely interpretation, analysis, evaluation, inference, explanation, and self-regulation. In the learning process, the tools used are quite diverse to explore Critical Thinking Skills (CBC). One of them is a popular book.

Popular urban edutourism books provide an opportunity for students to get to know the tourism potential in their neighborhood. They study in a natural environment, using the services of the natural environment without destroying it. They were guided by popular urban educational books.

Zaini and Asnida (2015) reported that learning in the natural environment using an environmental approach plays an important role in learning a biological concept because it can motivate students to teach biological concepts and thinking skills. In this case the teacher who delivers does not always have to be an ecologist or scientist, but rather someone who is able to be a guide in thinking about the environment around him and has a passion for finding relationships in ecosystems (Zaini, 2010).

On a micro scale, the steps taken are to improve environmental literacy as part of science and technology literacy. However, the existence of sources of information for students is still

limited. Moreover, specific learning resources in a particular area. One potential that might provide scientific literacy for students is the potential for urban edutourism.

The term popular book means popular science in book form. It can also be said to be a popular scientific book. Popular books are books that are arranged scientifically and structured, so that they will be easier for readers to learn and understand (Rofiqoh, 2012). Zakyah (2016) reports that this popular book is valid as reading material. Amroni (2016) also reports that popular books that are developed are suitable for use.

Learning to use popular books is seen from two sides, namely improving the quality of books and increasing the KBK of students. Book quality relates to valid, practical, and effective (Plomp & Nieveen, 2007), while KBK is through the research function of book effectiveness. Based on the description above, a research question is put forward about how the quality of popular urban edutourism books is the result of development to improve the cognitive skills of high school level students. In this study cognitive skills based on KBK.

Methods

The development research uses Tessmer's formative design, consisting of 4 steps, namely expert testing, individual testing, small group testing, and field testing. Each test aims to 1) determine the validity of the content, 2) the practicality of the content (attractiveness), 3) the practicality of expectations and the effectiveness of expectations, 4) the actual practicality and actual effectiveness. Preliminary research has produced a draft of an urban edutourism book. Furthermore, tests will be carried out according to the micro cycle using the formative design above. The research subjects of each test are presented in Table 1.

Table 1. Research Subjects and Test Types

Test Type	Purpose	Subject and Institution Origin	Number
Expert test	Content Validity	Lecturer in S2 Biology Education	3
Individual test	Content practicality	Class X1 students at SMA Negeri 4 Banjarbaru	3
Small group test	The Practicality of Hope	Class X1 students at SMA Negeri 4 Banjarbaru	3
	Hope Effectiveness	Class X1 students at SMA Negeri 4 Banjarbaru	3
Field test	Actual practicality	Class X1 students at SMA Negeri 4 Banjarbaru	15
	Actual effectiveness	Class X1 students at SMA Negeri 4 Banjarbaru	15

Popular book development instruments to determine validity, practicality, and effectiveness, and data analysis are presented in Table 2.

Table 2. Types of Data and Instruments Used

Types of Data	Instruments	Data Collection Techniques	Data Analysis Techniques
Content Validity	Expert opinion	Test	Descriptive
Content practicality	Student opinion	Test	Descriptive
The Practicality of Hope	Student response	Questionnaire	Descriptive
Hope Effectiveness	LKPD	Test	Descriptive

Data analysis and rubrics used are presented in Table 3.

Table 3. Data Analysis and Rubrics Used

Data Types	Instrument	Rubric
Content Validity	Expert opinion	4 = Very valid, 3-< 4 = Fairly valid, 2-< 3 Less valid, 1-< 2 Not valid
Content practicality	Student opinion	Very good (76-100%), Good (51-< 76%), Fair (26-< 51%), Poor (< 26%)
The Practicality of Hope	Student response	Very good (76-100%), Good (51-<76%), Fair (26-<51%), Poor (<26%)
Hope Effectiveness	LKPD	Very good (76-100%), Good (51-<76%), Fair (26-<51%), Poor (<26%)

Results and Discussion

A summary of the results of the validity of popular urban edutourism books is presented in Table 4.

Table 4. Summary of Average Popular Book Validity Test Results

Aspect	Indicator	CHAPTER					Category
		I	II	III	IV	V	
A. Coherence	1) Each paragraph has one main idea.	3,7	3,7	4	4	4	Valid
	2) Between sentences in a paragraph always use conjunctions.	3	3,3	3,3	3,3	3,3	Valid
	3) Main ideas in one paragraph sequentially	4	4	4	4	4	Very valid
	4) Several sentences composing the paragraph have led to understanding.	4	4	4	4	4	Very valid
B. Readability	5) The text is in accordance with the level of education.	4	4	4	4	4	Very valid
C. Vocabulary: expressions, verbs, choices, redundant	6) Avoid excessive use of expressions.	4	4	4	4	4	Very valid
	7) The use of vocabulary according to the level of education.	4	4	4	4	4	Very valid
D. Active and passive sentences	8) Avoid using sentences that are not clear, or show doubts.	3,7	4	4	4	4	Valid
E. Hedging: Words mean uncertainty.	9) Avoid using words that are not clear in meaning.	4	4	4	4	4	Very valid
F. Application, implication	10) Trying to raise current issues and their applications in the real world for the benefit of readers.	3	3	3	3	3	Valid
G. Definition and explanation	11) Using measurable words (describing, giving examples, analogies or metaphors) to facilitate the reader's understanding.	3,7	3,7	3,7	3,7	3,7	Valid

H. Other stylistic devices: narrative, humor, analogy	12) Using analogies to explain complex ideas.	3,7	3,7	3,7	3,7	3,7	Valid
	13) Using narrative with simple words to explain contexts that are difficult to understand.	3,3	3,3	3,3	3,3	3,3	Valid

Description: 4 (Very valid); 3 -< 4 (Valid); 2 -< 3 (less valid); 1 -< 2 (Invalid)

Table 4 describes popular urban edutourism books in the valid category, with an average of 3.74 (93.6%). Suggestions from the validator are accepted and have been corrected. A summary of the results of the validity of the LKPD is presented in Table 5.

Table 5. Summary of Average LKPD Validity Test Results

No	Indicator	LKPD (N = 3)						Category
		I	II	III	IV	V	VI	
1.	LKPD emphasizes the process aspect of finding concepts.	4 3 4	4 3 3	4 3 3	4 3 3	4 3 3	4 3 3	Valid
2.	The accuracy of the cases presented	3 4 4	4 4 4	4 4 4	4 4 4	4 4 4	4 4 4	Valid
3.	Systematic formulation of problems, hypotheses, tools and materials, procedures, research results, data analysis and conclusions.	3 2 4	3 2 4	3 2 4	3 2 4	3 2 4	3 2 4	Valid
4.	The use of pictures is interesting and supports the material/case presented.	3 4 4	3 3 4	3 3 4	3 4 4	3 3 4	3 3 4	Valid
5.	Use of language according to EYD.	4 3 4	4 3 4	4 3 4	4 3 4	4 3 4	4 3 4	Valid
6.	Simplicity of sentence structure.	4 3 4	4 3 4	4 3 4	4 3 4	4 3 4	4 3 4	Valid
7.	Interesting LKPD display.	4 4 4	4 4 4	4 4 4	4 4 4	4 4 3	4 4 4	Valid
8.	LKPD efficiency and its relation to time.	4 4 3	4 3 3	4 3 3	4 4 4	4 4 4	4 3 3	Valid
9.	LKPD efficiency and its relation to costs.	4 4 3	4 3 3	4 3 3	4 4 4	4 4 4	4 3 3	Valid
10.	LKPD efficiency and its relation to manpower.	4 3 4	4 4 4	4 4 4	4 4 4	4 4 4	4 3 4	Valid

Description: 4 (Very valid); 3 -< 4 (Valid); 2 -< 3 (less valid); 1 -< 2 (Invalid)

Table 5 describes valid LKPD, with an average of 3.61 (90%). A summary of the results of the content practicality test (readability, attractiveness) is presented in Table 6.

Table 6. Summary of Average Practicality Test Results for Popular Book Contents

No.	Statement	Score			Category
		1	2	3	
1	Every part studied is easy to understand.	2	3	3	Fairly good
2	The entire contents of the complete educational book (cover, editorial, preface, table of	4	4	3	Good

	contents, main contents, references, index, glossary)				
3	The words used are easy to understand.	3	3	2	Fairly good
4	The picture quality is good and understandable.	3	3	4	Good
5	Typo or grammar errors not found.	4	3	4	Good
6	The photo on the cover is clear and understandable.	3	2	3	Fairly good

Description: (4 = Very good, 3 = Good, 2 = Fairly good, 1 = Not good)

Table 6 describes the readability results of popular books in the good category, with an average of 3.11. A summary of the results of the practicality test for the contents of the LKPD is presented in Table 7.

Table 7. Summary of Average Practical Test Results for LKPD Contents

No.	Statement	Score			Category
		1	2	3	
1	Every part studied is easy to understand.	4	3	4	Good
2	The entire contents of the complete LKPD (cover, editorial, preface, table of contents, main contents, references, index, glossary)	4	3	4	Good
3	The words used are easy to understand.	4	4	3	Good
4	The picture quality is good and understandable.	3	2	3	Fairly good
5	Typo or grammar errors not found.	4	4	4	Very good
6	The photo on the cover is clear and understandable.	4	3	4	Good

Description: (4 = Very good, 3 = Good, 2 = Fairly good, 1 = Not good)

Table 7 describes the results of the legibility of the LKPD in the good category, with an average of 3.55. The quality of popular books and LKPD was still being improved by researchers before the ISBN was proposed. A summary of the results of the practicality test for popular book expectations is shown in Table 8.

Table 8. Summary of Average Expected Practicality Test Results

No.	Statement	Student Assessment										%	Category
		1		2		3		4		5			
		Y	T	Y	T	Y	T	Y	T	Y	T		
1	The contents of popular books are easy to learn and understand.		√	√		√		√		√		80	Good
2	Commands for acquiring critical thinking skills are easy to understand.	√		√		√		√		√		100	Very Good
3	The time allotted for studying this book is sufficient.	√		√		√		√		√		100	Very Good
4	If the study time exceeds the schedule, it can be continued outside of study hours.	√		√		√		√		√		100	Very Good

5	The contents of the book relating to critical thinking skills have never existed before.	√		√		√		√		√		100	Very Good
6	How to teach this book has never been implemented before.	√		√		√		√		√		100	Very Good
7	Interesting learning materials to learn.	√		√		√		√		√		100	Very Good

Description: 85.00–100.00% (Very good), 70.00 - < 85.00% (Good), 50.00 - < 70.00% (Not good), 00.00 - < 50.00 (Not good). Y = Yes, T = No

Table 8 describes the results of the practicality test with very good category expectations, with an average of 97.14%. A summary of the results of the effectiveness test of popular book expectations is contained in Table 9.

Table 9. Summary of Average Expected Effectiveness Test Results

No.	Name	Aspect/Maximum score/Number of items					
		Interpretation (14) (5)	Analysis (10) (6)	Evaluation (20) (6)	Inference (24) (5)	Explanation (20) (5)	Self-regulation (12) (5)
1.	Williano A. S. S.	38 (54%)	46 (77%)	92 (77%)	75 (63%)	54 (54%)	40 (67%)
2.	Regina A. A. M.	58 (82%)	46 (77%)	85 (71%)	75 (63%)	62 (60%)	42 (70%)
3.	Helma H. Yani	38 (54%)	41 (68%)	65 (54%)	56 (47%)	62 (62%)	36 (60%)
4.	Rata-rata (%)	63,33	74,00	67,33	57,66	58,66	65,66

Note: Very good (76-100%), Good (51-<76%), Fair (26-<51%), Not good (<26%)

Table 9 describes the results of the effectiveness test in the good category, with an average of 53.66% for all aspects.

Based on the results of the study, it was stated that the popular urban edutourism book inference was valid (score 3.73), as well as the LKPD that accompanied it was in a good category (3.61). The practicality of the content (readability of the book) is in the good category (3.11) as well as the LKPD (3.55). The practicality of expectations is good (97.14%), and the effectiveness of expectations is also in a good category (53.66%).

The validity of the contents of popular books is in the valid category, as well as the accompanying LKPD. LKPD is an integral part of popular books. These results are supported by previous studies (Andriyani, 2018; Arifah et al., 2012; Farkhati & Sumarti, 2019; Febrianty et al., 2017; Hariati et al., 2020; Hidayati et al., 2020; Husna et al., 2021; Rahimah et al., 2020; Sari et al., 2019; Zaini & Jumirah, 2016). The research object developed is valid because it meets the applicable aspects or indicators.

Validity relates to the accuracy of the assessment tool for the concept being assessed so that it really assesses what should be assessed (Sudjana, 2004). The consequence of this statement, before the instrument is used, instrument validation is carried out first. Input, suggestions and opinions from experts are taken into consideration to repair instruments.

Product validation can be done by presenting several experienced experts or experts (Azis, 2019). Each expert is asked to assess the product so that its weaknesses and strengths

can be identified. This activity is carried out to evaluate the product and provide input for improvement.

The score given by the validator is the final score after going through improvements according to the validator's request. The validated aspects are grouped into 1) suitability of materials, media, and adaptive capacity to science and technology, 2) writing consistency, 3) display of photos, charts, and graphs, 4) systematics, 5) critical thinking skills,

Content validity reflects the relationship between the material and the curriculum (Suseno, 2014). A product is said to have content validity if the product is made using solid theories (state of the art knowledge). Akker (1999) states that validity refers to a strong theoretical study (content validity).

The object of this research is a popular book, which is one of the teaching materials. Similar studies using different teaching materials also obtained valid categories as previously reported (Mardhatillah et al., 2020; Husna et al., 2021; Hariati et al., 2020). LKPD research objects are also valid categories (Mardhatillah et al., 2020; Hariati et al., 2020). Modules as independent teaching materials based on critical thinking skills are even very valid (Husna et al., 2021).

The expert position basically provides an intrinsic assessment. Rusdi (2018) explaining its intrinsic benefits can be useful in revising a product before further evaluation or testing is carried out. All aspects are assessed by the validator namely material, media, high adaptive power, consistency, photos known to students, easy to understand and attractive images, systematic content arrangement, good color and image combinations, assignments and exercises reflecting the demands of students' critical thinking skills educate.

The substance of popular books has fulfilled the validity aspect. Zahroh and Sudira (2014) stated that the criterion for deciding a learning instrument has an adequate degree of validity is if the average research results for all minimum aspects are in the valid category. If not, it is necessary to revise based on the validator's suggestions or evaluate aspects that are still lacking.

Rochmad (2012) argues that a development result (product) is said to be valid if the product is based on adequate theory and all components of learning products relate to each other consistently. Sumarna (2005) states that product validity is determined to determine product quality in relation to measuring what should be measured. The validity of valid popular books shows that the product can be further tested through students' opinions about the attractiveness of popular books through individual tests.

Zaini (2020) explained that validity data was obtained from the decision of a team of experts using a validation assessment format. Content validity describes how far the material is related to the curriculum (Suseno, 2014). Wahyuningsih (2011) explains that the use of media such as pictures and photos is very helpful in the learning process because it makes students motivated and active in the learning process.

The development of popular books obtains valid categories as reported by previous studies (Sari, 2019; Haqsari, 2014; Ikhwan & Kuncoro, 2021; Farkhati & Sumarti, 2019; Febriyanti et al., 2017). The results of this study explain the development of popular books in the category of valid and theoretically feasible because they have fulfilled the applicable aspects or indicators.

Student worksheets have an advantage in the aspects of photos on the cover known by students. Photos in popular books and worksheets are easy to recognize because most of them are found in natural environments. Wahyuningsih (2011) explained that the use of media is very helpful in the learning process because it makes students motivated and active, so that learning material is easily understood.

The criteria for popular books or other teaching materials are valid. This is supported by Ibrahim and Subali (2017) stating that validity refers to the validity of a teaching material. The

word valid is often interpreted as precise, correct, valid, and valid (Desmiwati et al., 2017). Thus popular books become a proper guide for students in the learning process so that they can learn actively and are able to learn independently because they follow the instructions in the LKPD (Rahayu et al., 2019).

Popular books are practical (easy to use) and have appeal. Several previous studies have supported these findings, even with different types of teaching materials (Andriyani, 2018; Arafah et al., 2012; Farkhati & Sumarti, 2019; Febrianty et al., 2017; Hariati et al., 2020; Hidayati et al., 2020; Husna et al., 2021; Rahimah et al., 2020; Sari et al., 2019; Zaini & Jumirah, 2016). The developed LKPD has an appeal. One of the objects of this research is LKPD. Similar research using different teaching materials also has the appeal as previously reported (Mardhatillah et al., 2020; Husna et al., 2021; Hariati et al., 2020).

Popular edutourism books have the advantage of the photos contained in them, because they are in the city of Banjarbaru. Wahyuningsih (2011) explains that the use of media such as pictures and photos is very helpful in the learning process because it makes students motivated and active in the learning process, so that learning material is easily understood.

Easy to use based on students' responses when using this book, namely a) ease of learning the contents of the book, b) clarity of instructions given, c) availability of time, d) ways of teaching and learning resources, and e) interest in learning materials. This book is attractive and easy to use, these findings are in line with previous research (Widiyani et al., 2021; Muhiddin, 2021; Putri et al., 2021; Erina et al., 2021; Fitriani et al., 2021; Amalia et al., 2021; Amalia et al., 2021; al., 2021; Sari et al., 2018). Attractiveness can be interpreted as content readability and practicality because it relates to one of the micro-cycles used in development research (Erina et al., 2021; Fitriani et al., 2021). Attractiveness can also be interpreted as feasibility (Widiyani et al., 2021; Marzuki & Muhiddin, 2021; Putri et al., 2021).

Easy to use through practicality test expectations (one of the micro-cycles in development research). This means that this book can be used in learning, even if done by a developer or researcher. This finding is in line with previous research reports (Marzuki & Muhiddin, 2021; Erina et al., 2021; Amalia et al., 2021).

Development research findings are a guarantee of quality. This model does not allow proceeding to the next stage if results are found under the agreed terms in the research rubric. So remedial is always open at every micro cycle. Popular books are used effectively because they can measure students' critical thinking skills. One way to improve students' thinking skills is by using educational books. This tour combines the concept of tourism with educational values. Through this book the local wisdom of the community will be preserved. Local wisdom as a tourism asset has been proven to have succeeded in several tourist villages (Suyanto et al. 2018).

The city of Banjarbaru as a tourist destination has an important and strategic position, especially in the field of land and air transportation (Pranata & Heldiansyah, 2015). This city has great potential to be developed into educational tourism. In line with the development of ICT, similar studies have been reported (Tosida et al., 2018). They reported the development of educational collaborative digital learning media that can be collaborated through multimedia applications.

When this book is used together with the LKPD, it is able to measure the KBK and the results are in a good category, with an average of 53.66% for all aspects. The aspects that are measured are a) interpretation, b) analysis, c) evaluation, d) inference, e) explanation, and f) self-regulation. Erina et al. (2021) found that aspects of interpretation were in a good category. Other aspects include analysis, inference, explanation and very good category self-regulation. Facione (2010) places the aspect of interpretation simpler than other aspects. In contrast to other studies (Amalia et al. (2021) reported that CBC was very good based on six aspects of

students' critical thinking skills, namely interpretation, analysis, evaluation, inference, explanation, and self-regulation.

This research measures KBK based on six aspects, in accordance with other research reports that take the average of all aspects. Aspects of students' critical thinking skills can also be measured from defining problems, making hypotheses, collecting data, analyzing data, and drawing conclusions. (Angkowati et al., 2018; Zaini, 2019).

Learning is carried out in educational tourism objects, Zaini and Asnida (2015) argue that learning in a natural environment using an environmental approach plays an important role in learning biological concepts because it can motivate students and think skills. Nur (2011) explained that learning process skills are not limited to being done in schools in whole classes, but can be carried out in small groups, or individually. Students can start working individually in class or at home, then discuss their strategies and results in small groups or the whole class.

Conclusion

1. Popular urban edutourism books are valid, with an average of 3.74 (93.6%), and the LKPD used is also valid, with an average of 3.61 (90%).
2. Has good category attractiveness, average 3.11, so does the LKPD used with good category, average 3.55. Easy to use based on student responses in the very good category, with an average of 97.14%.
3. It is used effectively because it can measure the critical thinking skills of students in the good category, with an average of 53.66% for all aspects.

Acknowledgement

Thank you to the principal of SMA Negeri 4 Banjarbaru, along with the school's board of teachers and staff. They play a role in conducting research from the beginning until the research report can be completed. Thanks also go to the students who played an active role in building a research umbrella in a wetland environment.

References

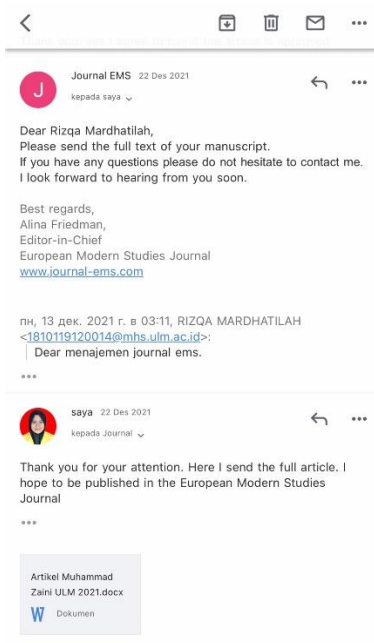
- Andriyani, E. Y. (2018). Development of Project-Based Electronic Student Worksheets on Thermochemistry Materials in Class XI SMA. *Chemistry Education*.
- Angkowati, J., Zaini, M., & Badruzsaufari, B. (2018). The effectiveness of learning module to train critical thinking skills. *European Journal of Education Studies*, 4(12), 118-129.
- Arafah, S. F., Priyono, B., & Ridlo, S. (2012). Development of LKPD Based on Critical Thinking on Animalia Material. *Journal of Biology Education*, 1(1).
- Aripin, I., Sugandi, M. K., Mu'minah, I. H., & Mulyani, A. (2020). 21st Century Biology Learning Training. *BERNAS: Journal of Community Service*, 1(3), 150-158.
- Astuti, T. P. (2019). Problem Based Learning Model with Mind Mapping in 21st Century Science Learning. *Proceedings of Biology Education*, 3(1), 64-73.
- Aziz, H. (2019). *Validity, reliability, practicality and effectiveness of printed teaching materials including handouts, modules and books*. Retrieved May 17, 2021, from <https://osf.io/fcx9e>
- Dakhi, O., Jama, J., & Irfan, D. (2020). Blended Learning: A 21st Century Learning Model At College. *International Journal of Multi Science*, 1(08), 50-65.
- Erina, Zaini, M, & Kaspul. (2021). Quality of e-LKPD on Vertebrate Sub-Concept Based on Critical Thinking Skills for High School Level. *Biology National Seminar Book Program 2021 Biology Research and Learning Innovation V (IP2B V) Biology Department, Faculty of Mathematics and Natural Sciences, Surabaya State University. Surabaya.*

- Fitriani, Zaini, & Kaspul. (2021). Quality of e-LKPD on the Ecosystem-Based Concept High School Level Critical Thinking Skills Biology *National Seminar Book Program 2021 Biology Research and Learning Innovation V (IP2B V) Biology Department, Faculty of Mathematics and Natural Sciences, Surabaya State University. Surabaya (11 September 2021)*.
- Facione, P. A. (1990). *Critical Thinking: A Statement of Expert Consensus for the Purposes of Educational Assessment and Instruction, Research Findings and Recommendations*. California: California State University, Fullerton.
- Farkhati, A., & Sumarti, S. S. (2019). Implementation of Integrated LKPD-E Assisted Chemistry Learning Management Chemoentrepreneurship to Analyze Student Soft Skills. *Chemistry in Education, State University of Semarang*, 8(2), 24–28.
- Febriyanti, E., Dewi, F., & Afrida. (2017). Development of LKPD-E Based Problem Solving on Chemical Equilibrium Material. *Journal of FKIP University of Jambi*.
- Hidayati, H., Zaini, M., & Kaspul. (2020). Effectiveness of Worksheets of Biology Students of High School Based on Critical Thinking Skills in Virus Concept. *BIO-INOVED: Journal of Educational Biology-Innovation*, 2(1), 41-46.
- Husna, N.A., Zaini, M., & Winarti, A. (2021). The Validity of Biology Module for Senior High School on Grade X in Even Semester Based on Critical Thinking Skills. *BIO-INOVED: Journal of Educational Biology-Innovation*, 3(1), 28-38.
- Haqsari, R. (2014). *Development and Analysis of Multimedia-Based LKPD-E (Electronic-Student Worksheets) on the Material of Operating Spreadsheet Software*. Yogyakarta State University Thesis.
- Hariati, M., Zaini, M., & Kaspul. (2020). The Effectiveness of High School Biology Students Worksheets Based on Critical Thinking Skills on the Protista Concept. *BIO-INOVED: Journal of Educational Biology-Innovation*, 2(1), 1-6.
- Ibrahim, M. 2021. The Covid-19 Pandemic and Learning Loss in Students. *Biology National Seminar Book Program 2021 Biology Research and Learning Innovation V (IP2B V) Biology Department, Faculty of Mathematics and Natural Sciences, Surabaya State University. Surabaya, 11 September 2021*.
- Khoirunnisa, E., & Habibah, E. (2020). Profile of 21st Century Skills (21ST Century Soft Skills) in Students. *Iktisyaf: Journal of Da'wah and Sufism*, 2(2), 55-68.
- Marsuki, N.I. & Muhiddin, A. (2021). Development of Scientific Literacy-Based Student Worksheets (LKPD) on Class X High School Functional Materials. *National Seminar on Biology Education XVII. "Innovation and Adaptation of Learning, Research, and Community Service in the Field of Biology and Biology Education in the Pandemic Era" Biology Education Study Program, Faculty of Teaching and Education, Sebelas Maret University, Surakarta (9-10 October 2021)*.
- Marisa, M. (2021). Innovation of the "Freedom to Learn" curriculum in the era of society 5.0. *Santhet: Journal of History, Education, and Humanities*, 5(1), 66-78.
- National Research Council (US). (2011). *Committee on the Assessment of 21st Century Skills. Assessing 21st Century Skills: Summary of a Workshop*. Washington (DC): National Academies Press (US).
- Pranata, E. R., & Heldiansyah, J. C. (2015). Seran Lake Tourism Park in Banjarbaru. *LANTING Journal of Architecture*, 4(2), 58-72.
- Putriani, J. D., & Hudaidah, H. (2021). Application of Indonesian Education in the Industrial Revolution Era 4.0. *Educative: Journal of Educational Sciences*, 3(3), 830-838.
- Prayogi, R. D. (2020). 21st century skills: The digital competencies of future educators. *Education Management*, 14(2), 144-151.

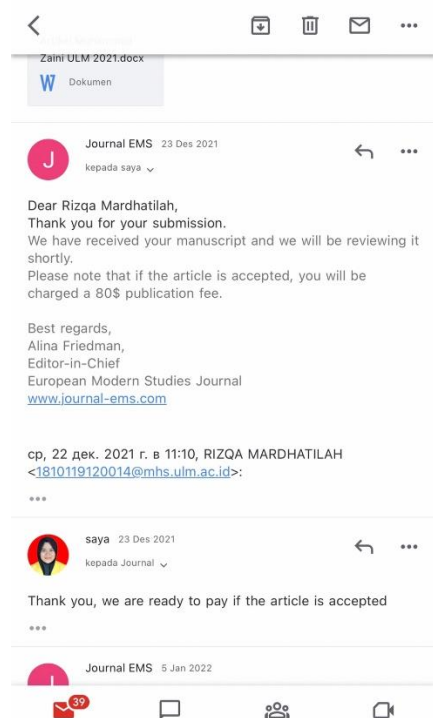
- Plomp, T. & Nieveen, N. (2007). An Introduction to Educational Design Research. *Proceedings of the seminar conducted at the East China Normal University, Shanghai (PR China)*.
- Rahayu, R., Iskandar, S., & Abidin, Y. (2022). 21st Century Learning Innovation and Its Application in Indonesia. *Basicedu Journal*, 6(2), 2099-2104.
- Rofiqoh, I. (2012). *Scientific Book Writing Techniques*. Retrieved April 18, 2017, from <http://iradina-rofiqoh.blogspot.co.id.teknik-penulisan-buku-ilmiah.html>.
- Rochmad. (2012). Model Design for Development of Mathematical Learning Devices. *Kreano's Journal*, 59-71.
- Rusdi, M. (2018). *Educational Design and Development Research (New Knowledge Concepts, Procedures and Synthesis)*. Depok: Rajawali Press.
- Sari, K., Sujarwanta, A., & Santoso, H. (2019). *Development of Inquiry-Based Student Activity Sheets (LKPD) to Improve Critical Thinking Skills*. 4(1), 24–5.
- Sari, N.N, Zaini, M., & Abdullah. (2018). Development Of Lesson Plan Instrument On Skeleton, Muscles And Simple Machine Topic For Junior High School: The Validity And The Practicality Test. *IOSR Journal of Research & Method in Education (IOSR-JRME)*.
- Sumarna, S. (2005). *Analysis, Validity, Reliability and Interpretation of 2004 Curriculum Implementation Test Results*. Bandung: PT Remaja Rosdakarya.
- Suyanto, E., Lestari, S., Wardiyono, F., Wuryaningsih, T., & Widyastuti, T. R. (2019). Community participation model in formulating cross-potential mangrove ecotourism policies supporting sustainable tourism villages in sea villages. *IOSR Journal of Environmental Science, Toxicology and Food Technology*, 13(8), 1-09.
- Tosida, E. T., Walujo, A. D., Suriyansyah, M. I., Bayu, H., & Nurfajri, R. (2018). Development of Situ Gede Edu Tourism Collaborative Digital Learning Media. *Charity: Journal of Community Service*, 1(1), 55-67.
- Tessmer, M. (1998). *Planning and Conducting Formative Evaluation*. London: Cogan Page.
- Zahroh, S. M. & Sudira, P. (2014). Development of Negotiation Communication Generic Learning Skills for Vocational High School Students Using the 4-D Method. *Vocational Education Journal*, 4(3).
- Zaini, M. & Asnida, D.J. (2015). Development of Mangrove Forest Oriented Biology Learning Devices for Junior High School Students. *Proceedings of the XII National Seminar on Biology Education FKIP UNS*, 134-141.
- Zaini, M. (2010). The Importance of Being Friendly with Nature to Restore Coastal Biological Biodiversity in Kalimantan *Seminar Papers Held in the Context of Biology Education Science Festival HIMBIO FKIP Unlam Banjarmasin 8-13 February 2010*.
- Zaini, M., & Jumirah, R. (2016). Development of Ecology Topic Learning Devices for Critical Thinking Skills of Madrasah Aliyah Students. *Indonesian Journal of Biology Education*, 2(1), 39-47.
- Zaini, M. (2019) The Effectiveness of Student Worksheets on Biological Concepts at the Madrasah Aliyah Level (An Educational Design Research). *Bioeducation: Journal of Biology Education*, 12(1), 20-29.
- Zaini, M., Naparin, A., Sumartono, Amintarti, S., Ajiza, A., & Karim. (2008). Preliminary Study of Environmental Education in Elementary Schools. Banjarmasin: *Collaboration between the Research and Development Agency for the Province of South Kalimantan and the Research Institute at the University of Lambung Mangkurat*.
- Zaini, M. (2010). The Importance of Being Friendly with Nature to Restore Biodiversity Urban Edutourism in Kalimantan *Seminar Papers Held in the Context of Science Festival of HIMBIO Biology Education FKIP Unlam Banjarmasin on 8-13 February 2010*.

- Zaini, M. (2014). Using Urban Edutourism to Teach Biological Concepts & Thinking Skills in Middle School Science Learning. Presented at the National *Seminar on the Biology Education Study Program FKIP, University of Palangka Raya on December 17, 2014.*
- Zaini, M. (2016). *The Urgency of Development Research in Exploring Critical Thinking Skills. Proceedings of the National Seminar on Science Education "Developing Higher Order Thinking Skills Through Learning Science."* S2 IPA UNLAM PRESS.

Koresponden Jurnal *Practicality and Effectiveness of Biological Liveworksheets in Measuring High School Students' Critical Thinking Skills*



Pengiriman abstrak artikel

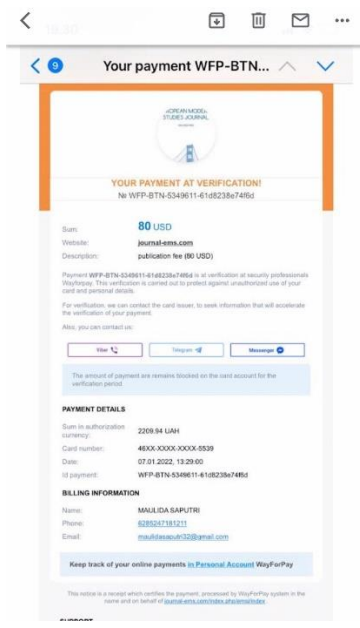
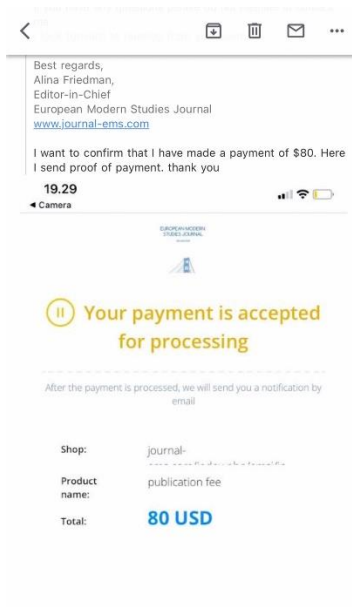
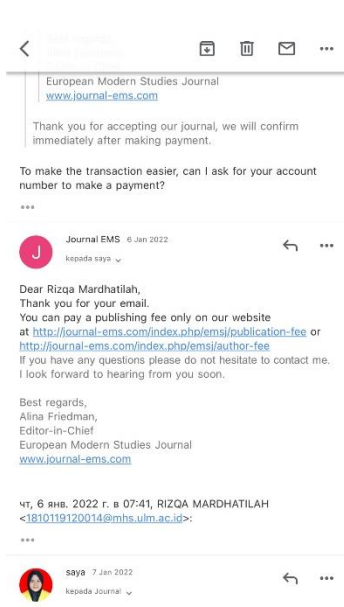


Artikel proses direview oleh editor

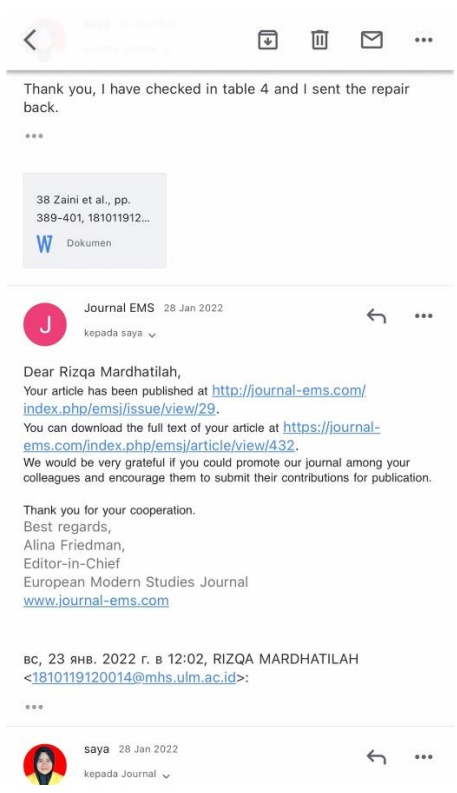
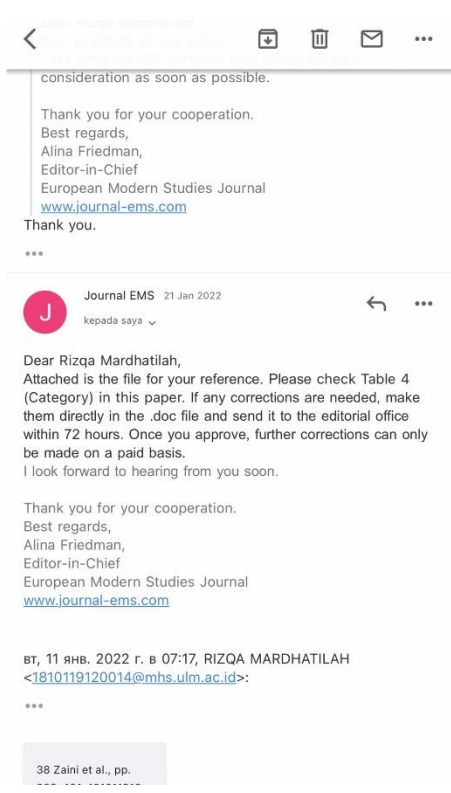
Pengiriman full teks artikel



Artikel selesai di review dan diterima untuk dipublikasi

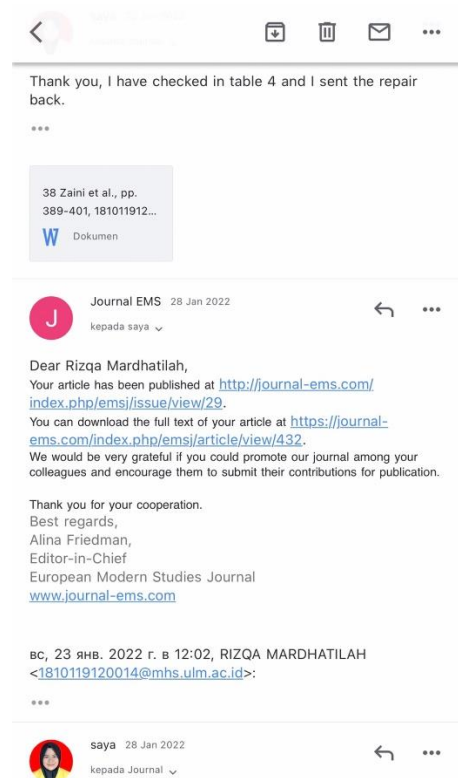


Pembayaran publikasi artikel



Permintaan untuk mencek penulisan pada table

Mengirimkan artikel setelah direvisi



Artikel diterima dan dikirimkan link publikasi