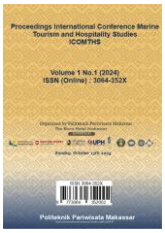

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Maritime Awareness in Ipas Subjects Using Tpack Assisted Discovery Model For Elementary School Students

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Abstract
Science and Social (IPAS) program offers a unique opportunity for students to engage with subject matter that is closely aligned with their daily lives. The IPAS program is designed to provide students with a comprehensive understanding of geographical conditions, ecosystems, and the surrounding environment. The program's objective is to provide students with an initial understanding of the potential wealth of Indonesia's natural resources in both agrarian and maritime fields. To facilitate this comprehension, educators must construct curricula that are malleable and situated within the real-world contexts of their students' lives, thereby rendering learning more meaningful. The objective of this research is to develop IPAS learning using the Discovery model with the assistance of TPACK, to facilitate the accommodation of students' diverse learning needs and the internalization of maritime awareness in their daily lives. This research was conducted using the research and development (R&D) method, employing the Lee & Owen model, which encompasses the following stages: needs assessment and front-end analysis, design, development, implementation, and evaluation. The trial design utilized in this development research consisted of a single group of 30 students from SDI Aisyiyah Jatinom, Blitar. The results of the trial demonstrate that the developed product meets the criteria for moderate effectiveness. This can be evidenced by the more active and explorative learning process, whereby students proactively offer opinions on the problems presented. Furthermore, the results of in-depth observations and interviews regarding the meaningfulness of maritime learning using the TPACK-assisted Discovery model are also discussed.
Keywords: Maritime awareness, IPAS , TPACK, discovery learning, primary education

1. INTRODUCTION

Indonesia is one of the largest maritime countries in the world and has a sea area of 5.9 million km2 (Hasanah, 2020). This has an impact on the huge potential of marine and fisheries resources for Indonesia. Therefore, providing knowledge about the maritime environment and the importance of the sea for students' daily lives is increasingly relevant, especially to foster maritime awareness and maintain the wealth of marine ecosystems for students.

Cultivating maritime awareness in students' daily lives can be done through good habituation practices in classroom learning. At the elementary school (SD) level, Natural and Social Sciences (IPAS) is a learning that discusses a lot about geographical conditions, potential natural resources, and the sea. In IPAS Learning, maritime is one of the challenging materials for students. This is because when learning maritime material, students need analytical skills, problem-solving, as well as knowledge of diverse marine ecosystems. Due to these skill requirements, learning maritime material increases students' cognitive load in the classroom.

Facts show that problem-solving on maritime material is still not the focus of teachers in IPAS learning at school. The presentation of the material is still limited to memorizing the names of sea objects. Meanwhile, maritime material has a broad scope, such as material on marine ecosystems, biodiversity, and challenges faced by the maritime environment, such as pollution and climate change. Unfortunately, the broad scope of the material is not matched by the use of appropriate methods, which tends to make students bored in class. Instead of trying to discover maritime concepts

and awareness, students are not challenged to explore the material presented by the teacher, so this has an impact on students' low summative scores.

In this context, students need comprehensive learning support. One of them is by designing innovative learning tools and models that can stimulate active discovery by students in solving maritime problems in the classroom. The use of e-modules as a learning tool combined with the discovery model is the right media to help students find a meaningful understanding of the maritime world. E-modules not only provide easy and flexible access, but also increase students' interactivity in learning through multimedia, such as video, audio, and animation.

Rozhana and Harnanik (2019) stated that the discovery learning model is a learning model that prioritizes the development of students' thinking in solving problems and emphasizes students' ability to find new ideas in the learning process. Furthermore, Discovery Learning is designed of help students develop thinking skills and develop abilities in solving everyday life problems, which emphasizes the importance of helping students to understand the structure or key ideas of a discipline, the need for active involvement of students in the learning process, and the belief that true learning occurs through personal discovery. develop abilities in solving everyday life problems. This is in line with Marisya and Sukma (2020) The discovery learning model is a learning model that requires students to be actively involved in learning and find their learning concepts.

The steps of discovery learning according to Windarti, et al (2018) are: 1) Stimulation, students are faced with something that raises curiosity, 2) Problem identification (Problem statement), the teacher provides opportunities for students to identify as many problems as possible which are formulated in the form of hypotheses, 3) Data collection, in this step students are allowed by the teacher to collect as much relevant information as possible to prove whether or not the hypothesis is correct, 4) Data processing, the activity carried out is to process the information /data that students collect in the previous step, 5) Proof (Verification), student proof is carried out with the teacher so that the learning process will run well, 6) concluding (Generalization), drawing a concluding by paying attention to the results of the proof obtained.

Today the way we acquire information and learn has changed significantly in the digital era, where technology has been utilized in various aspects of our lives. Designing lessons where technology is integrated is one of the teacher's efforts to assist students in achieving learning objectives. Previous research states that the use of technology in learning can provide benefits such as increasing learning efficiency and effectiveness, facilitating learning skills, and enriching learning content (Sarnoto, 2023). Mishra and Koehler (2006) state that when teaching with technology integration, teachers must have a knowledge framework called Technological Pedagogical Content Knowledge (TPACK). Furthermore, the TPACK framework includes: knowledge, content, and pedagogical.

The learning media developed with the TPACK framework results in an e-module integrated with the Discovery Learning Model that offers an interesting learning approach. This model not only encourages students to actively discover maritime concepts but also utilizes technology to enrich their learning experience.

2. RESEARCH METHODOLOGY

The research method used in this development research is the William W. Lee and Diana L. Owens model. The use of this model is based on considerations, namely (1) the Lee and Owens model is a complete, systematic, and adaptive development model, (2) specifically designed for the development of learning devices, (3) requires an analysis of learning needs aimed at solving learning problems. (Lee & Owens, 2004). In systematic development, some stages must be carried out, including Needs assessment and Front-end analysis, Design, Development, Implementation, and Evaluation. The Lee and Owens development design model with its components can be described as follows:

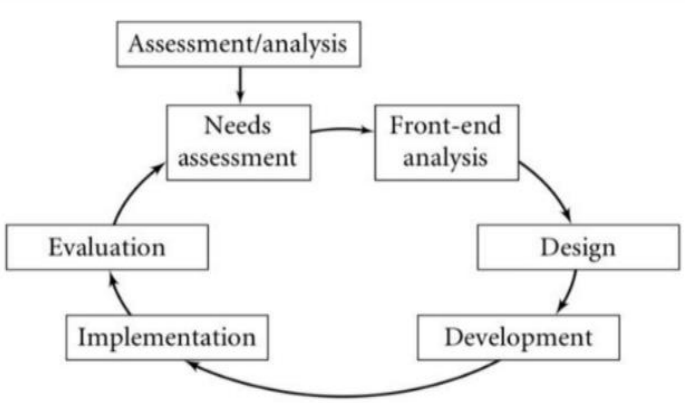

Figure 1. Syntax of Lee & Owens Development Model (2012)

This development research was conducted at SDI Aisyiyah Jatinom involving 30 grade V students as research subjects. The types of data generated in this development research are qualitative data and quantitative data. Qualitative data was obtained through responses and comments from experts. While quantitative data is obtained from questionnaire scores and learning outcomes tests of grade V.

In the assessment/analysis stage, there are important components in it, namely needs analysis and comprehensive analysis. In the needs analysis, it can be seen that the availability of teaching materials has not supported learning that involves students, and still focuses on LKS. Following up on this, of course, it is necessary to do some treatment to students to improve student learning outcomes. One of them is using teaching media that can facilitate students to be more active and more challenged to investigate and discover knowledge. Furthermore, a thorough analysis (front-end analysis) of fifth-grade students of SDI Aisyiyah Jatinom has an active character and diverse cognitive abilities. In learning, teachers have not actively involved students either through learning models, approaches, or media, learning orientation is still focused on textbooks and LKS. Students are familiar with technology, especially cell phones as a means of communication and playing games, then the school has adequate laptop, LCD, and internet network facilities.

At the Design stage, researchers carry out concept planning of the entire learning device design developed including: scheduling the development timeline, determining the project team, and media specifications.

Furthermore, in the development stage, at this stage, a discovery model-based e-module will be developed to improve student learning outcomes in maritime IPAS subjects for grade V SD. Starting from designing content, determining supporting media, developing instructions for using e-modules, and conducting formative revisions. This is done by analyzing product validity data. Data was obtained from the results of the questionnaire of material expert validators, and teaching material experts. then measured using the formula:

$$V = \frac{TSEV}{S - max} \times 100\%$$

The results were then categorized based on the following criteria:

Table 1. Criteria for the Validity of Teaching Materials & Materials

No	Criteria (%)	Level of validity
1	81- 100	Highly valid (can be used without revision)
2	61 - 80	Valid (can be used with minor revisions)
3	41 - 60	Less valid (can be used with major revisions
4	<40	Invalid (cannot be used)

Source: (Akbar, 2013)

Furthermore, data analysis of field practitioner validation. The data was obtained from one teacher of IPAS class V SDN Klampok in Blitar city. The data was then analyzed with the following steps: recapitulating research data on the validity of field practitioners into a table including aspects (A_i), indicators (I_i), and V_{ji} values for each validator. Then the average score of validation results from all validators for each indicator (I_i) is calculated based on the formula:

$$I_i = \frac{\sum_{j=1}^{n} V_{ji}}{n}$$

The average score for each aspect (A_i) is calculated by the formula:

$$A_i = \frac{\sum_{i=1}^{m} I_{ij}}{m}$$

The validity score (Va) or the total average of all aspects is calculated by the formula:

$$V_a = \frac{\sum_{i=1}^{n} A_i}{n}$$

The results obtained from the calculation will be adjusted to the validity criteria shown in the following table:

Table 2. Field Practitioner Validity

Validity score	Validity Criteria
$V_a = 4$	Highly Valid
$3 \leq V_a < 4$	Valid
$2 \leq V_a < 3$	Fairly Valid
$1 \leq V_a < 2$	Invalid

Furthermore, data analysis of e-module practicality. The data was obtained from a questionnaire of student responses to the use of e-modules. Then the student response data was analyzed using the formula:

$$Nilai\ kepraktisan = \frac{jumlah\ skor\ pada\ aspek\ yang\ dinilai}{jumlah\ skor\ total}$$

The data was then categorized based on the following criteria:

Table 3. Practicality Criteria

No	Criteria (%)	Practicality level
1	81% - 100%	Very practical
2	61% - 80 %	Practical
3	41% - 60%	Less practical
4	<40%	Not Practical

Source: Akbar (2013)

The next stage is implementation, at this stage the e-modules that have been developed are implemented in learning. The e-module was implemented for fifth grade students of SDI Aisyiyah Jatinom. The purpose of implementation is to obtain data on the effectiveness of the product that has been developed.

The final stage is evaluation, at this stage the effectiveness of the e-module is analyzed. Data was obtained from pre-test and post-test questions given to students. Next, a prerequisite test will be

carried out, with the help of IBM spss statistics 23, a normality test is carried out, this test uses Saphiro wilk. The basis for decision-making in the Shapiro-wilk normality test:

- If the significance value (sig) > 0.05, then the data is normally distributed
- If the significance value (sig) < 0.05, then the data is not normally distributed

The next step is to test the hypothesis. When the data is normally distributed, it will be tested using a paired sample t-test. The basis for decision-making is guided by the resulting significance value with the provisions that if the significance value (2-tailed) < 0.05, then H0 is rejected and Ha is accepted, if the significance value (2-tailed) > 0.05, then H0 is accepted and Ha is rejected.

The improvement of students' understanding ability before learning using e-modules assisted by discovery models and after the use of e-modules can be measured using the N-Gain test analysis. The results of the pre-test and post-test scores show that students' understanding has changed and the gain score is used to assess the success of the increase. N-gain can be calculated using the following formula.

$$indeks\ gain = \frac{skor\ posttest - skor\ pretest}{skor\ maksimum - skor\ pretest}$$

Furthermore, to categorize the N-Gain score according to Hake (1999) can be seen in the following table:

Table 4. Gain Score Criteria

Gain Score	Interpretation
$g > 0,7$	High
$0,7 > g > 0,3$	Medium
$g < 0,3$	Low

3. FINDINGS AND DISCUSSION

The final result of the research is an e-module developed within the TPACK framework based on the Discovery model to improve the learning outcomes of fifth-grade students. The e-module has a final format in the form of a PDF file made with the help of the Canva online graphic platform application. The material presented is from IPAS class V semester 2 material, namely Maritime Affairs. In the e-module there are 4 learning activities where each activity presents learning activities with discovery stages, namely 1) starting from interesting things, 2) understanding challenges, 3) investigating and collecting facts, 4) analyzing facts, 5) making conclusions 6) communicating results.

The resulting e-module product has the following form:

Figure 2. Discovery-based E-Module

3.1 Application of E-Modules in the Classroom

IPAS learning using e-modules with discovery learning stages was implemented in class V with maritime material. The learning e-module is designed to encourage students to actively engage in the learning process of conducting investigations and discovering information on their own through the use of this e-module. To enhance their understanding of the subject, they are given access to internet resources, practical exercises and real-world examples. Furthermore, the learning on this e-module is designed with collaborative learning type, where students tackle problems in groups and present their solutions.

3.2 Student Response to E-Modules

Learning IPAS using e-modules assisted by the discovery model is the first experience for fifth grade students of SDI Aisyiyah Jatinom. Facing new things, students seemed to respond enthusiastically, as evidenced in the opening stage students asked a lot about learning techniques, such as when they could operate laptops, and when to start the investigation. Initially, in activity 1 students were hesitant in expressing opinions, afraid of being wrong in taking actions, and lacking confidence when expressing opinions, and often asked for teacher validation “Ms, this is okay”, “Ms, i am confused”. This shows that students' dependence on the teacher is still very high.

In activity 2, students seemed to be adapting well, students were quite independent in starting the activity and more confident in expressing their opinions in front of other teams. It can be said that the learning design used can have an impact on students' enthusiasm for learning. How to take an attitude when a friend in the team has a different opinion, also appears when writing a prediction of a problem. Students discuss and determine which opinion is the strongest. In this case, the teacher as a facilitator monitors student activities and provides direction if needed. The teacher also helped remind the time of the activity, so that everything ran on time.

3.3 E-Module Validity

The validity test was conducted on one material expert,a teaching material expert, and one field practitioner. The results of the material test are summarized in the following table:

Table 5. Material Expert Validation Analysis Results

Answer Categories	Questionnaire score/item	Frequency of Answers	Total	Presentation
Very poor	1	0	0	0%
Less than good	2	0	0	0%
Good	3	1	3	2%
Very good	4	49	196	98%
Total			**199**	**100%**

Based on the data presented by the table, it shows the results of the e-module material validity test. It can be concluded that the e-module obtained a very good material validity qualification based on this data, it can be decided that the e-module that has been developed is declared valid in terms of material.

Table 6. Media Expert Validation Analysis Results

Answer Categories	Questionnaire score/item	Frequency of Answers	Total	Presentation
Very poor	1	0	0	0%
Less than good	2	0	0	0%
Good	3	11	33	30%
Very good	4	19	76	70%
Total			**109**	**100%**

Based on the data presented in the table, shows the results of the validity of the e-module media. It can be concluded that the e-module obtained a very good media validity qualification based on this

data, and a decision can be made that the e-module that has been developed is declared valid in terms of media.

Table 7. Results of Practitioner (Teacher) Validation Analysis

Answer categories	Questionnaire score/item	Frequency of Answers	Total	Presentation
Very poor	1	0	0	0%
Less than good	2	0	0	0%
Good	3	4	12	11%
Very good	4	24	96	89%
Total			**108**	**100%**

Based on the data that has been tabulated, it can be explained that the level of achievement of the practitioner (Teacher) of the e-module product on Indonesian material is rich in culture 96% and the calculations made are converted into Table 3. Table The level is in the 81% - 100% interval after the results of Product Validity are Very valid (can be used without revision).

3.4 Practicality of E-Modules

The e-module practicality test was conducted at SDI Aisyiyah Jatinom. The questionnaire was given to students after being given learning with e-modules for four meetings. At the fourth meeting students were given a practicality instrument.

Table 8. Product Practicality Level

No	Criteria (%)	Practicality level
1	81% - 100%	Very practical
2	61% - 80 %	Practical
3	41% - 60%	Less practical
4	<40%	Practical

Source: Akbar (2013)

Based on the practicality value obtained, it is 88% and is included in the very practical category for use. With a practicality value of 88%, the e-module on maritime material is considered very practical to use in the context of learning in grade V SDI Aisyiyah Jatinom. Is considered very practical to be used in the context of learning in class V SDI Aisyiyah Jatinom. The “very practical” category indicates that the implementation of e-modules not only provides benefits in improving student learning outcomes but can also be integrated smoothly and efficiently in the daily learning environment. This high practicality indicates that e-modules can be an effective and easy-to-implement solution in supporting the IPAS learning process in the classroom.

3.3 Effectiveness of E-Modules

The results of the saphiro wilk normality test analysis as presented in the following table:

Tabel 9. Tests of Normality

	Shapiro-Wilk		
	Statistic	df	Sig.
pretest	.944	30	.118
postest	.954	30	.217

From these results it can be read that the significance value (sig)> 0.05, so it can be said that the data is normally distributed, then for hypothesis testing using paired sample-t test to see the average difference before and after treatment on the same sample.

Tabel 10. *Paired Samples Test*

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE-TEST - POST TEST	-20.53333	6.44731	1.17711	-22.94080	-18.12587	-17.444	29	.000

Based on the above results, the sig value is 0.000 <0.05, indicating that the value obtained indicates that there is strong evidence to reject H0 and support Ha, which means that there is a significant difference between the ability before and after learning with e-modules assisted by the discovery model. Furthermore, the N-gain value was calculated using excel and the average N-Gain score was 0.53, this means that the inquiry-based e-module has moderate category effectiveness.

The effectiveness of learning using e-modules can be explained from the results of data analysis which shows a significant difference in the average value before and after learning. Based on the results of the paired sample t test, the significant value of 0.000 <0.05, this shows that there is strong evidence that there are differences in student learning outcomes. The positive effects that appear on students after using the e-module assisted by the discovery model include, 1) increased student understanding of maritime material, IPAS learning with this e-module changes traditional learning in the classroom into a dynamic and participatory learning environment by combining technology with discovery learning stages, 2) The improvement of students' abilities, related to the effectiveness of e-modules can be shown by the improvement of abilities that can be observed during the discovery stage process, namely, understanding challenges, investigating and collecting facts, analyzing facts, making conclusions, and communicating results.

4. CONCLUSION

Based on the development of e-modules assisted by the discovery model, the following conclusions can be drawn. 1) This e-module is very feasible to use in the learning process of grade V IPAS, this can be proven by an increase in student learning outcomes tests during the learning process. 2) The e-module assisted by the discovery model has high practicality as seen from the analysis of student responses obtained after the implementation of learning using the e-module. 3) The e-module assisted by the discovery model is effectively used to improve the ability of grade V students who are integrated into learning IPAS maritime material at SDI Aisyiyah Jatinom. This is evidenced by the increase in the average score on the student learning outcomes test after using the e-module assisted by the discovery model in learning for approximately one month.

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