



Development of an Inquiry-Based Learning Website Oriented toward Students' Self-Efficacy

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Abstract

This study aims to: (1) develop and describe the characteristics of inquiry-based learning websites oriented towards student self-efficacy in geometry, and (2) describe the feasibility of these learning websites in terms of validity, practicality, and effectiveness. This research is a Research and Development (R&D) study using the ADDIE (analysis, design, development, implementation, and evaluation) development model. The research was conducted at a Muhammadiyah junior high school in Depok, Yogyakarta, which was selected using purposive random sampling. The results of the study show that (1) an inquiry-based learning website oriented towards self-efficacy has been developed, and (2) the website meets the feasibility criteria with a validity level of “valid” in terms of material and “highly valid” in terms of media. In terms of practicality, the website was rated “highly practical” by teachers, ‘practical’ by students, and “highly practical” in terms of learning implementation. Effectiveness tests showed a significant increase in student self-efficacy after using the website, accompanied by the achievement of classical mastery. Thus, the learning website is declared feasible for use based on its validity, practicality, and effectiveness.

Keywords: *Learning Website; Inquiry Learning; Self-Efficacy*

Introduction

In learning mathematics, the problems encountered are not only related to students' understanding of concepts but also to their attitudes and perceptions toward the subject. This issue is important to address because negative perceptions of mathematics can significantly affect students' learning outcomes. Juliyanti & Pujiastuti (2020) stated that many students dislike mathematics because they perceive it as abstract, full of numbers, and dominated by formulas.

A negative perception of mathematics influences students' psychological performance. As highlighted by Juliyanti & Pujiastuti (2020), some students consider mathematics difficult and uninteresting, which leads to feelings of fear even before the learning process begins. This anxiety causes difficulty in maintaining concentration. Such fear, arising from the perception of difficulty, is associated with students' low confidence and belief in their ability to learn mathematics a concept closely related to self-efficacy.

One solution to address the aforementioned problems is the integration of digital technology to make learning easier, more engaging, and less abstract using visualization tools. Research by Ahmad et al. (2024) shows that the use of information technology in education has a significant impact on students' learning achievement. Most junior high school students are Generation Z, who are familiar with technology, which could reinforce these findings.

Although technology is already an integral part of students' lives, it has not been optimally utilized in educational contexts. According to data from the Central Statistics Agency (2023), while the Indonesian education system has a strong influence on students' internet use, the data indicate that in 2023, internet usage among students was still dominated by entertainment (86.65%) and social media (66.68%) rather than for learning purposes.

To overcome these problems, it is necessary to develop learning tools that meet students' needs, namely learning websites that leverage technology to create a more accessible and engaging learning environment. Bruning et al. (1999) states that the effectiveness of web-based learning depends on the quality of instructional methods that make optimal use of available technology. The inquiry learning model was chosen because it emphasizes experiential learning, or learning through discovery based on prior knowledge, which can enhance students' self-efficacy. This aligns with Bandura (1995, pp. 3–5) assertion that the primary source of self-efficacy is mastery experience.

Method

Based on the objective of this study, which was to develop a product, the research employed a Research and Development (R&D) approach. The development model used was the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2010: 2). This study was conducted at a Muhammadiyah junior high school in Depok, Sleman, involving eighth-grade students. The product trial was carried out during the 2024/2025 academic year, specifically in April 2025.

Before testing in schools, product prototypes and instruments were validated by experts. A geometry learning website with an inquiry model is considered valid if it meets two criteria: expert assessment shows that the geometry learning website with an inquiry model has a strong theoretical basis, and the geometry learning website with an inquiry model has components that are mutually compatible with one another.

The validity interval table is obtained through the interval distance formula:

$$J_i = (\text{highest score} - \text{lowest score}) / (\text{number of class intervals})$$

A trial was then conducted in one of the school's digital classes to obtain data on practicality and effectiveness. The instruments used to collect practicality data were practicality questionnaires for students and teachers and observation sheets on the implementation of learning.

A product is considered practical if it meets two criteria: observers state that the geometry learning website with an inquiry model used to facilitate students' self-efficacy abilities can be implemented in mathematics learning, and the developed learning website is declared easy to use and understand by teachers and students. The data on the implementation of learning was analyzed using the following percentage calculation:

$$P = \frac{M}{T} \times 100\%$$

Description:

P = Percentage of learning model implementation

M = Number of items implemented

T = Total number of items in the learning model implementation

The table of observation intervals for learning implementation was calculated using the formula from Widoyoko (2017, p. 110), but modifications were made to adjust the intervals as follows.

Table 1. Formula for Observation Intervals for Learning Implementation

Interval	Category
$\bar{x} + 2,1sb_i \leq x \leq \bar{x} + 3sb_i$	Very Practical
$\bar{x} + 1,2sb_i \leq x < \bar{x} + 2,1sb_i$	Practical
$\bar{x} + 0,3sb_i \leq x < \bar{x} + 1,2sb_i$	Fairly Practical
$\bar{x} - 0,6sb_i \leq x < \bar{x} + 0,3sb_i$	Less Practical
$\bar{x} - 3sb_i \leq x < \bar{x} - 0,6sb_i$	Very Less Practical

Source: modified from Widoyoko (2017, p. 110)

Description:

$\bar{x} = \frac{1}{2}$ (ideal maximum value + ideal minimum value)

$\bar{x} = \frac{1}{6}$ (ideal maximum value - ideal minimum value)

The table below shows the percentage of learning implementation observations with a maximum score of 100%.

Table 2. Learning Implementation Observation Intervals

Interval	Category
$85\% \leq x \leq 100\%$	Very Practical
$70\% \leq x < 85\%$	Practical
$55\% \leq x < 70\%$	Fairly Practical
$40\% \leq x < 55\%$	Less Practical
$0\% \leq x < 40\%$	Very Less Practical

In the effectiveness data, data was collected using a student self-efficacy questionnaire instrument. Effectiveness data analysis was conducted using univariate tests, namely the Two-Sample Dependent T-test and, finally, the Classical Completion Proportion test. The effectiveness criteria used were there was a significant increase between the students' self-efficacy abilities before and after the treatment, and more than 75% of students obtained a self-efficacy score of 70 or higher.

Results and Discussion

Results

This study aimed to produce a product and ensure that the product met appropriate quality standards. The developed product was considered feasible if it met three criteria: validity, practicality, and effectiveness (Nieveen, 1999, p. 126; Nieveen, 1997, p. 40; Akker, 1999, p. 10). Product validation was

carried out by experts, involving two validators: a material expert and a media expert, both of whom are lecturers from the Department of Mathematics Education, Yogyakarta State University.

This validation was carried out to ensure that the developed product had a strong theoretical foundation and aligned with the learning objectives. The material expert's assessment obtained a total score of 72 out of a maximum of 90, with a percentage of 80%. Based on the validity criteria, a score of 72 falls within the range of $66 < x \leq 78$, which corresponds to the "Good" category. The media expert's assessment obtained a total score of 66 out of a maximum of 70, with a percentage of 94.29%, which corresponds to the "Very Good" category. The validation results from both experts indicate that the learning website is feasible to be implemented, as it possesses sufficient theoretical foundation and consistency among its components.

Tessmer (2013, pp. 47–101) stated that the quality of a product needs to be evaluated through the evaluation stage, namely the small group evaluation. After the data were validated by experts, the next step was to conduct a small group trial before implementing it in the actual classroom. The results of this trial indicated that the product was more effectively accessed using a laptop; therefore, in the implementation stage, laptops were prepared by the students and the school. The implementation stage produced data on practicality and effectiveness.

The practicality data showed that the teacher's assessment of the learning website in terms of practicality obtained a total score of 75 out of a maximum score of 80, with a percentage of 93.75%. Based on this result, the learning website was categorized as very practical according to the teacher's evaluation. Furthermore, the students' average score for the practicality assessment of the learning website was 56.86 out of a maximum score of 70, with a percentage of 81.23%. Based on the students' responses, the learning website met the practical criteria. Therefore, the developed learning website was considered easy to use and understand by both teachers and students. The percentage of learning implementation activities for both teachers and students from meetings 1 to 3 was 92.86%, with each activity categorized as very practical. Hence, the observers concluded that the learning website could be implemented effectively in mathematics learning.

Product effectiveness data was obtained from the results of pretest and posttest self-efficacy questionnaires. Before testing the hypothesis, the data was analyzed and found to meet the assumptions of univariate normality, as follows.

Table 3. Normality Test Results

Test	Results
P-Value	0.8556
Test Criteria	Reject H_0 if P-Value $< 0,05$
Conclusion	Data is Normally Distributed

Since the normality assumption has been met, hypothesis testing using the t-test can be performed. Univariate hypothesis testing was performed on the self-efficacy data separately with the following results.

Table 4. Results of the Two-Sample Dependent T-Test

T-Test	Self-Efficacy Questionnaire
P-Value	2.423e-11
T-Value	10,509
Test Criteria	Reject H_0 if $t > 1,703$
Conclusion	There is a significant increase

It was concluded that there was a significant average increase between the posttest and pretest scores on student self-efficacy. After that, to ensure that this increase indicated that all students had mastered the material well, a proportion test needed to be conducted.

A proportion test was conducted to prove whether students had achieved classical mastery, namely more than 75% of students obtained a score greater than or equal to 70. The results of the analysis are shown in the following table.

Table 5. Results of the Proportion Test

Proportion Test	Self-Efficacy Questionnaire
P-Value	0.0044
Test Criteria	Reject H_0 if P-Value $< 0,05$
Conclusion	The mastery proportion was achieved

Based on the results, it can be concluded that classical mastery was achieved. Therefore, based on all the tests conducted, the developed product meets the criteria for effectiveness.

Discussion

The developed product is considered successful and feasible for use if it demonstrates good quality based on three essential criteria: validity, practicality, and effectiveness (Nieveen, 1999, p. 126; Nieveen, 1997, p. 40; Akker, 1999, p. 10). This discussion will elaborate on these three feasibility criteria of the developed product along with its characteristics.

This product has several characteristics, consisting of general and specific characteristics. The general characteristics of the learning web that has been developed are: 1) The learning web allows students to learn anywhere and anytime; 2) The learning web contains illustrations that can help in building knowledge related to surface area and volume from a geometric approach; 3) The learning web is equipped with interactive features to provide feedback based on student responses.

In addition to the general characteristics, this product also has specific characteristics related to the identity inherent in the product, namely the use of an inquiry learning model in the learning activity steps and a focus on self-efficacy, which is the ability to improve.

The learning activities in the product consist of inquiry learning steps, namely the planning phase, retrieving phase, processing phase, creating phase, sharing phase, and evaluating phase. In the planning

phase, students are asked to plan what they will do to discover a concept that is still a mystery. The activities carried out by students in the planning phase are presented in the following figure.



Figure 1. Activities in the Planning Phase

In the Retrieving phase, students search for information relevant to the topic they want to solve, with the following examples.

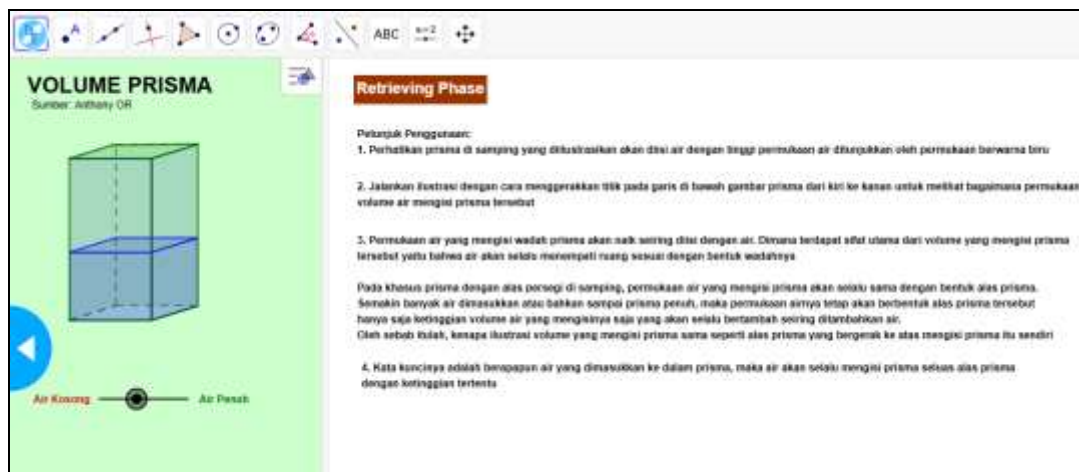


Figure 2. Activities in the Retrieving Phase

After the information is collected in the retrieving phase, it is then processed in the processing phase. At this stage, students process the information they must draw conclusions from the problems investigated in the liveworksheet.

After students discover the concept themselves, they then share their findings with the teacher and other students in the sharing stage. The teacher assesses the students' answers. If a student's answer is incorrect, it will disappear and the student will be asked to rewrite it based on input from the teacher or other students. This activity is part of the evaluating phase. An example of this activity is as follows.



Figure 3. Activities in the Sharing Phase and Evaluating Phase

This product focuses on self-efficacy, which has three indicators formulated from its dimensions, namely level, strength, and generality. The level dimension indicator relates to students' belief in their ability to solve problems at various levels of difficulty. The learning website provides example sentences used to increase students' self-efficacy in terms of level, such as when students are looking for the concept of pyramid volume: “You will find it easy if you already understand the concept of prism volume” and “Observe carefully, this will make it easier for you to find the formula for pyramid volume.”

An example of a sentence used to increase students' self-efficacy in terms of strength is when students are looking for the concept of prism volume, such as “you can do it, don't worry. The process of finding it will be easy if you follow the instructions provided.” The generality indicator is “by remembering this concept, you will definitely be able to find all the formulas for prism and pyramid volume.”

Based on the research results, it was found that the validation results from two validators, namely subject matter experts and media experts, produced valid criteria. This shows that the learning website already has a sufficient theoretical basis and that the components of the learning website are compatible.

The results of the practicality assessment based on the research results show that the product meets the Practical criteria because the product can be understood and used by students and teachers, and also can be implemented in the learning process. The effectiveness of the learning website based on the self-efficacy questionnaire hypothesis test data has met the effective criteria. The self-efficacy results for each indicator in the posttest data are presented in the following table.

Table 6. Self-Efficacy Achievement Results for Each Indicator

Indicator	Average Percentage	Category
Confidence in one's ability to complete tasks at various levels of difficulty.	70,61%	Fair
Confidence in one's ability to persist in difficult tasks.	78,93%	Good
Confidence in one's ability to complete tasks in various situations, including new situations.	75%	Good
Average	75,04%	Good

The analysis results show that the average achievement of students for each indicator generally falls into the good category. However, there is one indicator that still falls into the Fair category, namely the level indicator with a percentage of 70.61%. Students' lack of mastery of this level indicator indicates that the learning website still needs to be improved to build students' confidence in their ability to

complete tasks at various levels of difficulty. Achievements on the other two indicators were rated as good. This indicates that the learning website can increase students' self-efficacy, particularly on the strength and generality indicators.

The results of this study are reinforced by the results of research and development by Wahyuni et al. (2025), who developed a learning website using the 4D development model with the result that the use of web-based mathematics learning media contributes positively to increasing self-efficacy because students' confidence in their ability to understand and solve mathematical problems has increased.

The results of research by Arrofit & Dewi (2025), who studied a learning website in the form of a digital worksheet based on Heyzine Flipbook, concluded that this learning media is suitable for optimizing self-efficacy. This is in line with the findings in this study, namely that a Nearpod-based learning website combined with Geogebra and Liveworksheet can also be used to increase self-efficacy, particularly in the dimensions of strength and generality.

In addition to learning websites, the inquiry learning model also plays an important role in increasing student self-efficacy. There are research results that found that students who participated in learning with the inquiry model showed an increase in self-efficacy (Anggraeni & Khuzaeni, 2025; Sopari et al., 2022). This is related to one of the main sources of self-efficacy, namely mastery experiences (Bandura, 1995, pp. 3–5). This is because when students have successfully discovered the concepts of surface area and volume of prisms and pyramids with the guidance provided by the inquiry model assisted by features on the learning website, their confidence in their abilities will increase.

Conclusion

The results of research and development of learning web products using the ADDIE development model yielded several conclusions, namely the characteristics of the learning web developed and the feasibility of the developed product. The characteristics of the learning web as a product of research and development are that the activities on the learning web are designed using the inquiry learning model and the learning web is oriented towards increasing self-efficacy.

The quality of the learning web meets the criteria for suitability for use in terms of validity, practicality, and effectiveness, because: 1) the validity assessment results from subject matter experts obtained a total score of 72 out of a maximum score of 90, thus obtaining a rating of Good. The assessment results from media expert validators obtained a total score of 66 out of a maximum score of 70 with a Very Good criterion; 2) the practicality assessment results by teachers obtained a total score of 75 out of a maximum score of 80 with a Very Practical criterion. The assessment results by students obtained an average score of 56.86 out of a maximum score of 70 with a Practical criterion. The observation sheet for the percentage of learning implementation in teacher and student activities from meetings 1-3 was 92.86% with a rating of Very Practical for each activity; 3) the results of the analysis of the effectiveness of the learning website showed that there was a significant increase in students' self-efficacy before and after the treatment. In addition, it was also concluded that more than 75% of students obtained self-efficacy scores equal to or greater than 70.

References

- Ahmad, I. F., Setiawati, F. A., Prihatin, R. P., Fitriyah, Q. F., & Thontowi, Z. S. (2024). Technology-based learning effect on the learning outcomes of Indonesian students: a meta-analysis. *International Journal of Evaluation and Research in Education*, 13(2), 892–902. <https://doi.org/10.11591/ijere.v13i2.25383>.

- Anggraeni, M. T., & Khuzaeni, N. (2025). Pengaruh Model Pembelajaran Inquiry untuk Meningkatkan Self-Efficacy Siswa. *Indonesian Research Journal on Education*, 5(1), 589–593.
- Arrofit, M. F., & Dewi, N. R. (2025). Numerasi Peserta Didik Ditinjau dari Self-Efficacy pada Pembelajaran Preprospec Berbantuan LKPD Digital Berbasis Heyzine Flipbook. *PRISMA (Prosiding Seminar Nasional Matematika)*, 8, 204–212. <https://journal.unnes.ac.id/sju/index.php/prisma/>.
- Bandura, A. (1995). *Self-efficacy in changing societies*. Cambridge university press.
- Branch, R. M. (2010). Instructional design: The ADDIE approach. In *Instructional Design: The ADDIE Approach*. Springer US. <https://doi.org/10.1007/978-0-387-09506-6>.
- Bruning, R. H., Schraw, G. J., & Norby, M. M. (1999). *Cognitive Psychology and Instruction*.
- Data Badan Pusat Statistik. (2023). *Statistik Pendidikan 2023*.
- Juliyanti, A., & Pujiastuti, H. (2020). Pengaruh kecemasan matematis dan konsep diri terhadap hasil belajar matematika siswa. *Prima: Jurnal Pendidikan Matematika*, 4(2), 75–83.
- Nieveen, N. (1999). Prototyping to reach product quality. In *Design approaches and tools in education and training* (pp. 125–135). Springer.
- Nieveen, N. M. (1997). *Computer support for curriculum developers: A study on the potential of computer support in the domain of formative curriculum evaluation*.
- Sopari, Y. W., Daniarsa, Y., & Ulfatushiyam, N. (2022). Pembelajaran Inkuiri Terbimbing Untuk Meningkatkan Kemampuan Berpikir Kritis, Komunikasi Matematis, Self-Efficacy Matematis. *Pasundan Journal of Mathematics Education: Jurnal Pendidikan Matematika*, Vol 12 No 1, 60–75. <https://doi.org/10.23969/pjme.v12i1.5278>.
- Tessmer, M. (2013). *Planning and conducting formative evaluations*. Routledge.
- Van den Akker, J. (1999). Principles and methods of development research. In *Design methodology and development research in education and training/Kluwer Academic Publishers*.
- Wahyuni, S., Dewi, I., Nasution, H., William Iskandar Ps, J. V, Baru, K., Serdang, D., & Utara, S. (2025). Development of Web-Based Mathematics Learning Media to Improve Reasoning Ability and Self-Efficacy of High School Students. *Jurnal Perspektif*, 244(2), 244–257. <https://doi.org/10.15575/jp.v-9i2.354>.
- Widoyoko, E. P. (2017). *Teknik Penyusunan Instrumen Penelitian*. Pustaka Pelajar.

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