Development of Guided Inquiry Based E Module on Immune System to Increase Student Argumentation

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ABSTRACT

This study explores the development and effectiveness of guided inquiry-based e-modules focused on the immune system to enhance students' argumentation skills. Conducted at MAN Kota Tegal, the research adopts a Research and Development approach with the ADDIE development model. The study aims to determine the feasibility of creating these e-modules and assess their impact on students' argumentation skills. Data collected, both qualitative and quantitative, includes validation from subject matter, instructional design, and media experts, as well as feedback from teachers and students. The e-modules received high validation scores, with 97.5% from subject matter experts, 93.8% from instructional design experts, and 96.2% from media experts, indicating their credibility. Teacher feedback and student responses further supported the effectiveness, with approval rates of 75% and 87.1%, respectively. The N-gain test categorized the effectiveness as moderately effective, and paired sample t-tests revealed a significant improvement in students' argumentation skills, reaching the highest level 6 in the posttest with an average score of 78.83. Overall, the study highlights the potential of guided inquiry-based e-modules in enhancing students' argumentation skills related to the immune system.

Introduction

21st-century learning emphasizes the importance of mastering the 4Cs, which consist of critical thinking, collaboration, communication, and creativity (Prihadi, 2018). Critical thinking is defined as the ability to engage in high-level thinking because it involves students' ability to compare two or more pieces of information they possess (Rizaldi et al., 2019). Viyanti et al. (2020) state that critical thinking skills can serve as a means to develop students' argumentation skills. Sumarni et al. (2017) also support this concept by stating that critical thinking skills can be developed alongside students' argumentation skills. Irwanto et al. (2018) add that critical thinking skills and argumentation skills influence each other, where in critical thinking, students are trained to construct and influence arguments. Deane & Song (2014) explain that argumentation involves

the most complex critical thinking skills in learning.

According to the Big Indonesian Dictionary (KBBI), argumentation means writing that contains the author's opinion, accompanied by reasons and proofs supported by facts presented logically and objectively to convince and influence readers. Mcneill (2006) defines argumentation as an activity that involves comparing theories accompanied by logical explanations. Toulmin et al. (1984) define argumentation as the process of associating ideas with appropriate reasons, according to the available data. Tippet (2009) categorizes argumentation into two types, namely written and oral argumentation. Demircioglu & Ucar (2015) stated that not all students can convey arguments orally, so some students prefer to convey arguments in writing. Umami et al. (2012) explained that the ability of written argumentation involves channeling thoughts in written form accompanied by evidence so that it becomes valid. According to Mc. Neill & Krajcik (2011) the indicators of argumentation skills include claim (statements to answer questions), evidence (scientific data that support statements) and reasoning (reasons that connect statements and data, accompanied by appropriate scientific principles). Measurement of students' argumentation ability level can be categorized according to the provisions in Table 1.

Table 1 Level and Student's Argumentation Skills

Level	Indicator
0	Student does not answer the question.
1	Students provide arguments that are wrong or unrelated to the statement.
2	Students provide argumentation in the form of precise claims without data or reasons.
3	Students provide argumentation in the form of precise claims accompanied by data or reasons but do not show the connection.
4	Students provide argumentation in the form of precise claims accompanied by evidence but do not link to reasons.
5	Students provide argumentation in the form of precise claims accompanied by connecting reasons but do not include data.
6	Students provide argumentation in the form of precise claims by including evidence and linking to reasons.

(Henderson & Osborne, 2019)

Noviyani et al. (2017) added that having argumentation skills can help students improve conceptual understanding. Vera et al. (2021) explained that knowing students' argumentation skills allows teachers to determine the actions that need to be taken to improve understanding and achieve the desired cognitive level of students. Rahayu et al. (2020) revealed that students' written argumentation skills can be improved through the application of learning models, methods, and approaches that can develop students' written argumentation skills, one of which is through the use of guided inquiry model (Mulyasari et al., 2020).

Rais et al. (2020) explained that guided inquiry learning is a learning model guided by the teacher, where students learn a concept analytically, critically, and scientifically argumentatively by involving certain stages to reach a conclusion. Hansen (2002) states that in guided inquiry, the teacher's role is to provide the problems and materials needed by students, and then students design the process to be carried out to obtain solutions. In guided inquiry, the learning process encourages students to be able to ask questions, conduct analysis, interpret evidence, and provide effective solutions to solve problems (Lee, 2012).

Maniotes & Kuhltau (2014) detail that the syntax of guided inquiry learning consists of the stages of open, immerse, explore, identify, gather, create, share, and evaluate. Sulistyana et al. (2023) simplified these stages into problem orientation, problem identification, formulating hypotheses, collecting data, analyzing data, communicating, and making conclusions. Aisyah & Wasis (2015) argue that guided inquiry can train students' argumentation

skills through the aspects of claim, evidence, and reasoning. The claim aspect can be honed with the syntax of hypothesis formulation, evidence can be trained with the syntax of investigation or data collection, and the reasoning aspect can be trained through the syntax of data analysis. Marhamah et al. (2017) emphasized that students' argumentation skills can be enriched through inquiry activities that involve students in learning to draw appropriate conclusions based on the evidence they obtain from research.

The application of the learning model requires the use of media to facilitate the delivery of material to students (Mulyasari et al., 2020). Based on the results of the student needs questionnaire, there are various preferences for learning media, where 29.6% of students like learning using e-modules, 27.8% of students like learning using videos, 25.9% of students like learning using websites, and 16.7% of students like learning using learning applications. In addition, the results of the student needs questionnaire also show that students tend to approve the use of learning media that offers convenience for students and presents learning materials comprehensively.

The questionnaire results show that more students like learning media in the form of modules. Modules are teaching materials in learning that contain brief and specific information, designed to achieve learning objectives (Meyer, 1978). On the other hand, e-modules are modules that are packaged in electronic form, allowing the display of material, images, animations, and videos (Laili, 2019). Utomo (1991) explains that the use of e-modules in learning allows students to learn according to their individual ability levels, and after learning students can assess the level of understanding they have achieved. Herdiana et al. (2021) mentioned that the application of e-modules for science learning can be used more easily if combined with a learning model. Lasmiyati & Harta (2014)explained that in learning using modules there are advantages such as in the module there are clear learning objectives, feedback through self-evaluation activities, an attractive design, ease of learning, student learning

motivation, flexibility and makes it easier for students to work together.

The results of research conducted by Hendarto et al. (2019) and Susilawati et al. (2023) mentioned that the development of guided inquiry-based modules can improve students' argumentation skills. This research uses the ADDIE development model. Molenda (2003) mentioned the advantages of the ADDIE model as a sequential but also interactive learning model. Cheung (2016) stated that the ADDIE model is easy to use in the learning context. The material contained in the guided inquiry-based e-module developed is the body defense system of class xi science. Based on the background, there are objectives in this study, namely 1) Knowing the feasibility of guided inquiry-based e-modules on body defense system material to improve students' argumentation skills. 2) Knowing the effectiveness of using guided inquiry-based e-modules on the material of the body's defense system to improve students' argumentation skills. 3) Improve students' argumentation skills using e-modules based on guided inquiry on the material of the body's defense system.

Method

The research method used is research and development (RnD) by applying the ADDIE model, which consists of 5 stages namely analysis, design, development, implementation, and evaluation. The population in this study were 11th grade high school science at MAN Tegal City, Central Java Province, Indonesia. The sample used was 11th grade science class students 4 totaling 35 students. sampling was carried out using the purposive sampling method. Purposive sampling is sampling with certain considerations (Sugiyono, 2008). The data collected included quantitative and qualitative data. Quantitative data included student pretest and posttest results, as well as assessments from experts, teachers, and students on e-modules. Qualitative data was collected in the form of suggestions and input from experts, students, and teachers for the improvement of e-modules. Quantitative data was obtained by analyzing the results of the needs questionnaire, validation by experts, and responses from

teachers and students. The questionnaire assessment was carried out using a Likert scale of 1-4. Likert scale assessment categories can be found in Table 2.

Table 2 Likert Scale Rating Category

Score	Category
4	Very Feasible
3	Feasible
2	Decent Enough
1	Not Feasible

(Arikunto, 2013)

The results of the validated product questionnaire were calculated to get a percentage with the formula used in Akbar & Hartono (2017).

Percentage score $= \frac{n}{N} \times 100$

n = Number of scores obtained
N = Maximum number of scores

The percentage score results obtained are categorized according to Table 3.

Table 3 Learning Media Feasibility Category

Percentage (%)	Category	Description
85,01-100 %	Very Feasible	Can be used without revision
70,01-85,00 %	Feasible	Can be used with minor revisions
50,01-70,00 %	Decent Enough	Can be used after major revision
01,00-50,00 %	Not Feasible	Not usable

(Akbar & Hartono, 2017)

The effectiveness of guided inquiry-based e-module development on students' argumentation skills was measured from the pretest and posttest scores. The calculation of the results of the two tests used the n-gain test and paired sample t-test. The formula for calculating n-gain is as follows.

$$\text{N-Gain} = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

(Hake, 1998)

The N-gain test results are divided into several categories. N gain test results are categorized based on Table 4

Table 4 Effectiveness Category N-Gain

Percentage (%)	Interpretation
<40	Not Effective
40 - 55	Less Effective
56 - 75	Modarately Effective
>76	Effective

(Hake, 1998)

To determine the increase in scores in the pretest to posttest using the paired sample t-test test. The paired sample t-test results show significance with a value of less than 0.05, indicating a difference in value before and after the application of guided inquiry-based e-modules (Kumala et al., 2022).

Results and Discussion

The following are the results of research and development of guided inquiry-based modules using ADDIE steps. The analysis stage is carried out by analyzing learning, analyzing student needs, and analyzing concepts. Researchers conducted a learning analysis through interviews with teachers. The learning method often used by teachers is the lecture method. The lecture method is a presentation of lessons conducted by the teacher through oral explanation directly in front of students (Tambak, 2014). The results of the analysis of student needs conducted by filling out a questionnaire showed that 29.6% of students liked learning using e-modules, 27.8% of students liked learning using videos, 25.9% of students liked learning using websites and 16.7% liked learning using learning applications. The results of the student needs questionnaire also show that more students agree to the use of learning media that can provide convenience and contain complete learning material for students. Concept analysis was conducted by analyzing core competencies, basic competencies, and defense system materials.
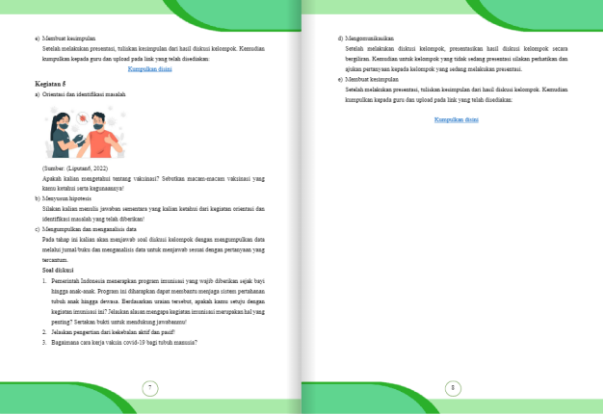
The second step of the researcher conducts the design stage by designing the learning media e-module. The design process includes the preparation of learning
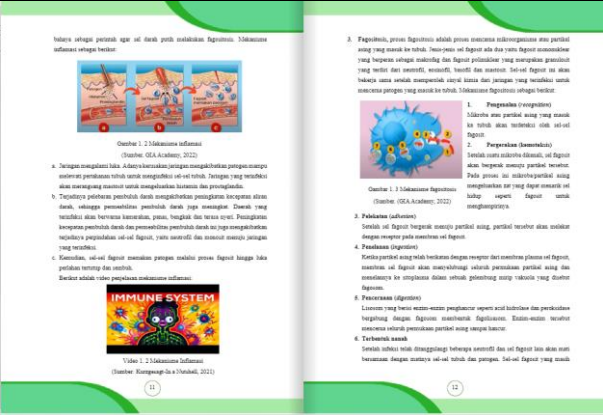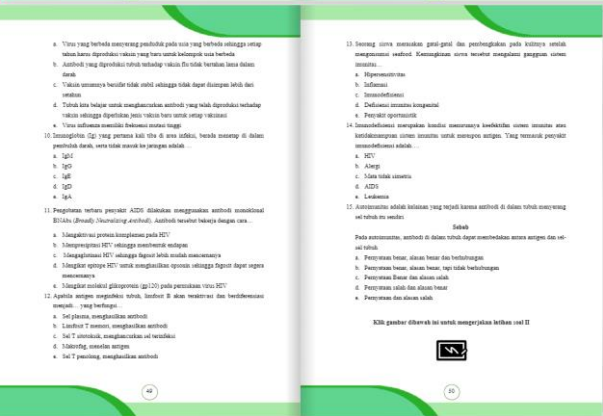
instruments, materials, learning media development, and research instruments. Learning instruments consist of lesson plans (RPP) as well as pretest and posttest questions. The lesson plan is based on the guided inquiry structure, including problem orientation, identification, hypothesis formulation, data collection and analysis, communication, and conclusion. The pretest was conducted before using the e-module, while the posttest was conducted after the learning was completed using the e-module. The material contained in the guided inquiry-based e-module is the body's defense system, taken from books and relevant research journals. The material is arranged following the basic competencies 3.14 and indicators of achievement of competencies that have been formulated.

Relevant images and videos were added to support learning. The tools used to develop e-modules are Canva, Microsoft Word 2019, and Heyzine. Canva was used to create page and background designs, Microsoft Word 2019 for e-module drafting, and Heyzine for e-module publication. The e-module can be accessed via smartphone or PC with screen size adjustment. The e-module assessment instrument is intended for learning experts, materials, media, as well as teacher and student responses to the e-module. The assessment instrument was used to assess the feasibility of the e-module.

The third step is the development of e-modules based on guided inquiry. the following are the results of the e-module development.

Table 5 Development Research of E-Modules Based on Guided Inquiry

No.	Page View	Description
1.		The first page is the cover. Making the cover page using Canva is equipped with relevant images to beautify the appearance of the module.
2.		The page contains guided inquiry-based learning activities consisting of orientation and problem identification, formulating hypotheses, collecting and analyzing data, communicating, and making conclusions.

No.	Page View	Description
3.		The page contains a description of the material of the body's defense system equipped with pictures and explanatory videos.
4.		The page contains practice questions in the form of multiple choice

Before the e-module is tested, an assessment of the e-module is carried out by learning, material, and media experts. The results of the experts' assessment can be seen in Tables 6, 7, and 8.

Table 6 Learning Expert Validation Assessment Result

No	Aspects	Score	Category
1.	Format of Lesson Plan	100%	Very Feasible
2.	Content of Lesson Plan	75%	Feasible
3.	Language and Writting	100%	Very Feasible
4.	Benefits of The Lesson Plan Sheet	100%	Very Feasible
	Average	93.8%	Very Feasible

Table 7 Material Expert Validation Assessment Result

No.	Aspects	Score	Category
1.	Content Feasibility	96.4%	Very Feasible
2.	Language	100%	Very Feasible
	Average	98.2%	Very Feasible

Table 8 Media Expert Validation Assessment Result

No	Aspects	Score	Category
1	Size of E-Module	100%	Very Feasible
2	Cover Design of E-Module	95.8%	Very Feasible
3	Design of E-Module	92.9%	Very Feasible
	Average	96.2%	Very Feasible

Table 6 shows that the value obtained from learning experts has an average of 93.8% and is a very good category. Table 7 shows that the value obtained from material experts has an average of 98.2% and is a very

good category. Table 8 shows that the value obtained from media experts has an average of 96.2% and is a very good category. In addition to the assessment, the e-module validation also contains suggestions and input from expert validators which are used for improvement before being implemented to students. The validated guided inquiry-based e-module was tested with students.

The implementation stage was carried out by applying guided inquiry-based e-modules to learning. The e-module was tested in class 11th science at MAN Tegal City. The learning process was divided into two meetings. Students were given a pretest in the form of description questions to measure argumentation skills before using guided inquiry-based e-modules. The pretest results showed that students with level 0 argumentation ability were 15%, level 1 was 8%, level 2 was 19%, level 3 was 51% and level 4 was 8%. While students with level 5 and 6 argumentation skills do not exist. Learning continued with the distribution of e-module access links and the introduction of guided inquiry-based e-modules on the material of the body's defense system. The teacher divided the class members into 5 groups for each group to work on one activity.

The guided inquiry-based activities in the e-module are described as follows. The orientation and problem identification stages are made into one point in the form of a short question to attract student interest. The hypothesis formulation stage directs students to write answers to orientation and problem identification points. The stage of collecting and analyzing data is made into one point consisting of discussion questions. Each group of students is directed to answer discussion questions by finding reference sources from books, journals, and internet sources. The sources or data that students have collected will be analyzed to determine relevant answers as answers to discussion questions. The communicating stage is carried out by each group presenting the results of the group discussion by describing the answers to the questions of the orientation and problem identification stages and the discussion questions at the stage of collecting and analyzing data. The stage of making conclusions is done by

adding the results of the discussion that has been presented with questions from students who are spectators and students collect the results of group discussions on hyperlinks with the words "Collect here". The second meeting is carried out with the same learning stages as the first meeting. After all activities are completed, on the second meeting students will be given posttest questions to measure argumentation skills. Based on the results of the student posttest after treatment using guided inquiry-based e-modules, there is an average argumentation ability possessed by students at levels 1 and 2 none, level 3 as much as 4%, level 4 as much as 41%, level 5 as much as 35% and level 6 as much as 21%. The results of the pretest and posttest comparison can be seen in Figure 1.
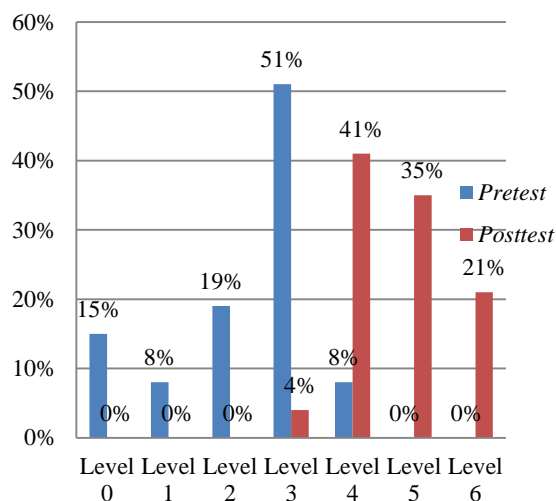

Figure 1 Comparison Chart of Pretest and Posttest Averages

Data analysis was carried out with the N gain test and obtained a score of 0.664 and n gain percent of 66.4% and included the category effective enough to improve students' argumentation skills. The paired sample t-test was also conducted to determine changes from the pretest to post-test. The paired sample t-test results showed that the average pretest score was 37.09 and the average posttest score was 78.83. A comparison of the average pretest and posttest scores shows that there is an increase in scores after students use guided

inquiry-based e-modules in learning. Based on the results of the paired sample t-test test at the significance level (2-tailed), the result is 0.00. The significance value is less than 0.05, so it is concluded that there is a change in value from pretest to posttest. The paired sample t-test results can conclude that there is a significant difference between students' argumentation skills before and after using guided inquiry-based e-modules. Students and teachers responded to the use of e-modules based on guided inquiry in the form of questionnaires. The results of student and teacher responses can be seen in Tables 9 and 10.

Table 9 Student Response Results

No.	Assessment Aspect	Score	Category
1.	Attractiveness Aspect	86.4%	Very Feasible
2.	Material Aspect	88.6%	Very Feasible
3.	Language Aspect	87.9%	Very Feasible
4.	Presentation Aspect	85.4%	Very Feasible
	Average	87.1%	Very Feasible

Table 10 Teacher Response Results

No.	Assessment Aspect	Score	Category
1.	Attractiveness Aspect	75%	Feasible
2.	Material Aspect	75%	Feasible
3.	Language Aspect	75%	Feasible
4.	Presentation Aspect	75%	Feasible
	Average	75%	Feasible

The results of student responses have an average percentage of 87.1% and have a very feasible category. The teacher response results have an average of 75% and have a decent category. There are also suggestions and input from students to increase the number of videos listed in the e-module. The teacher gave suggestions in the form of adding HOTS questions to the practice questions section.

The evaluation stage is the last step in the ADDIE design development model. At this stage, evaluation is carried out through questionnaires from teachers and students, as well as pretests and posttests, to assess the effectiveness of using e-modules in improving students' argumentation skills after using guided inquiry-based e-modules in learning. Based on the n-gain test for the pretest and posttest, a value of 0.664 was obtained. According to (Hake, 1998), these results are included in the category of effective enough to improve students' argumentation skills.

The pretest results show that the highest level achieved by students is level 4, with indicators that students can provide argumentation in the form of a precise claim, accompanied by evidence, but not linking to reasoning. The posttest results have increased, namely the level of students' argumentation skills reaching level 6 with indicators that students can provide argumentation in the form of precise claims by including evidence and connecting with relevant reasons.

The improvement of students' argumentation skills can be more clearly known using the comparison of pretest and posttest scores calculated using paired sample t-test. The results of the paired sample t-test test showed an increase in value, with the average pretest score of students in class 11th grade science 4 being 37.09 increasing to 78.83 in the post-test score. The result of the significance value of the paired sample t-test is 0.00. The provisions in the paired sample t-test test are if the significance value is smaller than 0.05, it can be concluded that there is a difference in students' argumentation skills before and after the use of guided inquiry-based e-modules (Kumala et al., 2022).

Overall, from the results of the pretest and posttest, students' argumentation skills increased after the use of e-modules based on guided inquiry. This is because before learning using e-modules based on guided inquiry, students did not recognize the components of argumentation, lacked activities that could improve students' argumentation skills, and could not answer questions accompanied by argumentation components. Farida & Widia (2014) argued

similarly that poor argumentation skills can be caused by a lack of involvement and understanding of concepts owned by students. In addition, (Supeno, 2016) mentioned that students are still not familiar with the argumentation ability test. This proves that argumentation skills must be trained (Laila & Puspitawati, 2019). In the guided inquiry-based module developed, there is a series of guided inquiry syntax and discussion questions in the form of descriptions that can train students' argumentation skills

This is because the guided inquiry learning model allows students to develop argumentation skills (Aisyah & Wasis, 2015). Laila & Puspitawati (2019) added that each syntax in guided inquiry can be used to measure students' argumentation skills. The ability to formulate claims can be trained with the syntax of hypothesis formulation. Data collection syntax has an important role in finding the concept in question (Sanjaya, 2014) and can develop the ability to compile evidence (Aisyah & Wasis, 2015). Data analysis syntax is carried out to classify aspects of argumentation (Rochman & Yuliani, 2021) and can train aspects of reasoning (Aisyah & Wasis, 2015). In the e-module that has been developed, the syntax of problem orientation and problem identification contains short questions to attract students' interest in learning so that it can train students to identify problems. The syntax of hypothesis formulation in the e module encourages students to formulate problem hypotheses by answering questions in the syntax of problem orientation and identification, to train students' claiming skills. The syntax of data collection and data analysis is carried out by providing description questions so that students discuss answers with group members, by collecting data from relevant literature sources, to train students' evidence and reasoning skills. Based on the relationship between guided inquiry syntax and indicators of argumentation skills and research results, guided inquiry-based modules can be used to train students' argumentation skills on the material of the body's defense system.

Conclusion

The conclusions of this study are as follows: (1) The developed e-module received a high percentage in the assessment from validators and student responses, as well as teacher responses, indicating good quality. (2) The guided inquiry-based e-module is effective in improving students' argumentation skills, with an N gain of 66.4%. (3) There was a significant increase in students' pretest scores, from 37.09 to 78.83 on the posttest, indicating an increase in students' argumentation skills from level 4 to level 6. Further product development suggestions include: (1) Add HOTS questions to the e-module, (2) Present more videos and pictures, and (3) Conduct a wider scale trial.

Acknowledgment

References

Aisyah, I., & Wasis. (2015). Penerapan Model Pembelajaran Inkuiri untuk Melatihkan Kemampuan Argumentasi Ilmiah Siswa pada Materi Kalor di SMAN 1 Pacet. *Jurnal Inovasi Pendidikan Fisika (JIPF)*, *04*(02), 83–87.

Akbar, F. I., & Hartono, R. (2017). Pengembangan Lembar Kegiatan Peserta Didik Dengan Model Pengembangan 4-d Pada Materi Mitigasi Bencana dan Adaptasi Bencana Kelas X SMA. *Jurnal Pendidikan Geografi*, *22*(2), 135–147.

Arikunto, S. (2013). *Dasar-Dasar Evaluasi Pendidikan*. Bumi Aksara.

Cheung, L. (2016). *Using The Addie Model of Instructional Design to Teach Chest Radiograph Interpretation*. Pearson.

Deane, P., & Song, Y. (2014). A case study in principied assessment design: Designing assessment to measure and support the development of argumentative reading and writing

skills. *Psicologia Educativa*, *20*(1), 99–108. https://doi.org/10.1016/j.pse.2014.05.006

Demircioglu, T., & Ucar, S. (2015). Investigating the effect of argument-driven inquiry in laboratory instruction. *Kuram ve Uygulamada Egitim Bilimleri*, *15*(1), 267–283. https://doi.org/10.12738/estp.2015.1.2324

Farida, I. Ch., & Widia, F. G. (2014). Profil Keterampilan Argumentasi Siswa Pada Konsep Koloid yang Dikembangkan Melalui Pembelajaran Inkuiri Argumentatif. *Edusains*, *6*(1), 32–40.

Hake, R. R. (1998). Interactive Engagement vs Traditional Methods : Six-Thousand Student Survey of Mechanics Test Data For Introductory Physics Course. *American Journal of Physics* , *66*(1).

Hendarto, P., Maridi, & Prayitno, A. B. (2019). Validity of Guided Inquiry-Based Modules on Digestive System to Improve Argumentation Skill. *Jurnal Pendidikan Biologi Indonesia*, *5*(1), 127–140.

Henderson, J. B., & Osborne, J. F. (2019). *Using Computer Technology to Support the Teaching and Learning of Argumentation in Chemistry*. 79–105.

Herdiana, L. E., Sunarno, W., & Indrowati, M. (2021). Studi Analisis Pengembangan E-Modul Ipa Berbasis Inkuiri Terbimbing Dengan Sumber Belajar Potensi Lokal Terhadap Kemampuan Literasi Sains. *Inkuiri: Jurnal Pendidikan IPA*, *10*(2), 87. https://doi.org/10.20961/inkuiri.v10i2.57247

Irwanto, A. D., Saputro, E., Rohaeti, A. K., & Prodjosantoso. (2018). Promoting Critical Thinking and Problem Solving Skills of Preservice Elementary Teachers through Process Oriented Guided-Inquiry Learning (POGIL).

International Journal of Instruction , *11*(4), 777–794.

Kumala, S. A., Dwitiyanti, N., & Widyatun, F. (2022). Efektivitas Penggunaan Media Pembelajaran Berbasis Android Sififi Pada Materi Besaran dan Satuan. *Jurnal Inovasi Penelitian*, *2*(8), 2755–2762.

Laila, B. B. A., & Puspitawati, R. P. (2019). THE EFFECTIVENESS OF STUDENTS WORKSHEET BASED ON INQUIRY BY DESIGN ARGUMENTATION ACTIVITY IN BRYOPHYTE. *Bioedu Berkala Ilmiah Pendidikan Biologi*, *8*(3), 172–177. http://ejournal.unesa.ac.id/index.php/bioedu

Laili, I. (2019). EFEKTIVITAS PENGEMBANGAN E-MODUL PROJECT BASED LEARNING PADA MATA PELAJARAN INSTALASI MOTOR LISTRIK. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, *3*(3).

Lasmiyati, & Harta, I. (2014). Pengembangan Modul Pembelajaran untuk Meningkatkan Pemahaman Konsep dan Minat SMP. *Pythagoras: Jurnal Pendidikan Matematika*, *9*(2), 161–174. http://journal.uny.ac.id/index.php/pythagoras

Lee, V. S. (2012). What Is Inquiry Guded Learning ? . *New Direction For Teaching and Learning*, *2012*(129), 5–14.

Maniotes, L. K., & Kuhltau, C. C. (2014). *The Shift From Traditional Research Assignments to Guiding Inquiry Learning*. *43*(2).

Marhamah, O. S., Nurlaelah, I., & Setiawati, I. (2017). Penerapan Model Argument-Driven Inquiry (Adi) Dalam Meningkatkan Kemampuan Berargumentasi Siswa Pada Konsep Pencemaran Lingkungan Di Kelas X Sma Negeri 1 Ciawigebang. *Quagga : Jurnal Pendidikan Dan Biologi*, *9*(2), 39–45. https://doi.org/10.25134/quagga.v9i02.747

Martin-Hansen, L. M. (2002). *Defining inquiry*. https://www.researchgate.net/publication/287494829

Mc. Neill, K. L., & Krajcik, J. (2011). *Supporting Grade 5-8 Students in Constructing Ecplanation in Science* .

Mcneill, K. L. (2006). *Supporting students' construction of scientific explanation through generic versus context-specific written scaffolds*. https://www.researchgate.net/publication/228850868

Meyer, R. (1978). *Designing Learning Modules For Inserrice Teacher Education* . Centre For Advancement Of Teaching.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement*, *42*(5), 34–36. https://doi.org/10.1002/pfi.4930420508

Mulyasari, E., Yuliani, & Dewi, S. K. (2020). Keefektifan Lembar Kegiatan Peserta Didik (Lkpd) Berbasis Guided Inquiry Pada Materi Pertumbuhan Dan Perkembangan Untuk Melatihkan Keterampilan Argumentasi. *Bioedu Berkala Ilmiah Pendidikan Biologi*, *9*(2), 186–192. https://ejournal.unesa.ac.id/index.php/bioedu

Noviyani, M., Kusairi, S., & Amin, M. (2017). Penguasaan Konsep dan Kemampuan Berargumentasi Siswa SMP Pada Pembelajaran IPA Dengan Inkuiri Berbasis Argumen. *Jurnal Pendidikan : Teori, Penelitian Dan Pengembangan*, *2*(7), 974–978. http://journal.um.ac.id/index.php/jptpp/

Prihadi, E. (2018). Pengembangan Keterampilan 4C Melalui Metode Poster Comment pada Mata Pelajaran PAI dan Budi Pekerti (Penelitian di SMA Negeri 26 Bandung). *Semangat Pusat Kajian Islam JPI Rabbani*, 464–479.

Rahayu, Y., Suhendar, S., & Ratnasari, J. (2020). Keterampilan Argumentasi Siswa Pada Materi Sistem Gerak SMA Negeri Kabupaten Sukabumi-Indonesia. *BIODIK*, *6*(3), 312–318. https://doi.org/10.22437/bio.v6i3.9802

Rais, A. A., Hakim, L., & Sulistiawati, S. (2020). Pemahaman Konsep Siswa melalui Model Inkuiri Terbimbing Berbantuan Simulasi PhET. *Physics Education Research Journal*, *2*(1), 1. https://doi.org/10.21580/perj.2020.2.1.5074

Rizaldi, D. A., Makhrus, M., & Doyan, A. (2019). Analisis Tingkat Kemampuan Berpikir Kritis dengan Model Perubahan Konseptual Ditinjau Dari Gaya Belajar Siswa . *Jurnal Pendidikan Fisika Dan Teknologi*, *5*(1), 74–81.

Rochman, A. K., & Yuliani. (2021). Pengembangan Lembar Kerja Peserta Didik Elektronik (E-Lkpd) Berbasis Inkuiri Pada Submateri Fotosintesis Untuk Meningkatkan Kemampuan Argumentasi Peserta Didik. *BioEdu Berkala Ilmiah Pendidikan Biologi*, *10*(3), 663–673. https://ejournal.unesa.ac.id/index.php/bioedu

Sanjaya, W. (2014). *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Fajar Interpratama Mandiri.

Sugiyono. (2008). *Metode Penelitian Kuantitatif Kualitatif dan R & D*. Alfabeta.

Sulistyana, Y., Indrowati, M., & Ariyanto, J. (2023). Effectiveness of Guided Inquiry-Based Mosiry E-Module on the Immune System in Improving Student's Integrated Science Process Skills (SPS). *Journal of Learning for Development (JL4D)*, *10*(2), 267–279.

Sumarni, W., Sudarmin, Wiyanto, Rusilowati, A., & Susilaningsih, E. (2017). Chemical literacy of teaching candidates studying the integrated food chemistry

ethnosciences course. *Journal of Turkish Science Education*, *14*(3), 60–72. https://doi.org/10.12973/tused.10204a

Supeno. (2016). *Model Pembelajaran Penyelesaian Masalah Argumentatif untuk Meningkatkan Hasil Belajar Fisika Kognitif Produk, Keterampilan Proses Sains & Ar*.

Susilawati, S., Windyariani, S., & Nuranti, G. (2023). Pengembangan E-Module Berbasis Inkuiri Terstruktur untuk Melatih Keterampilan Argumentasi Siswa SMP/MTs. *Jurnal Pendidikan Mipa*, *13*(3), 563–572. https://doi.org/10.37630/jpm.v13i3.1107

Tippet, C. (2009). Argumentation : The Language of Science . *Journal of Elementary Science Education*, *21*(1), 17–25.

Toulmin, S. , E., Rieke, R., & Janik, A. (1984). *An Introduction To Reasoning* (2nd ed.). Macmillan.

Umami, F., Sunaryo, & Syahri, M. (2012). *Analisis Karangan Argumentasi Siswa Kelas XI SMKN 12 Malang Tahun Pelajaran 2011/2012*.

Utomo, T. (1991). *Peningkatan dan Pengembangan Pendidikan*. Gramedia Pustaka Utama.

Vera, V., Anwar, Y., & Ermayanti, E. (2021). The Correlation Between Scientific Argumentation With Viruses Learning Outcomes Of Senior High School Student. *Biosfer*, *14*(1), 54–64. https://doi.org/10.21009/biosferjpb.10998

Viyanti, V., Cari, C., Prasetyo, Z. K., & Maulina, H. (2020). Does the Cognitive Activity can Generate Student's Physics Argumentation Performance Features? *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *9*(1), 177–183. https://doi.org/10.24042/jipfalbiruni.v9i1.6264