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Analysis of the Need for Development of a Practical Science E-Guidebook for UIN Sunan Kalijaga Students

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Abstract: Practical E-Guidebook is a facility for practicum activities that contains digital-based instructions and information so that students can carry out practicum activities independently. The aim of this research is to analyze the need for practical science e-guidebooks for UIN Sunan Kalijaga students. This research uses the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development research model in the analysis stage. The data collection techniques used in this research were interviews and questionnaires to determine the analysis of students' needs for the Practical E-Guidebook. The aspects analyzed in this research are analysis of independent practicum activities for elementary science learning, analysis of tools and materials in the laboratory in independent practicum activities for elementary science learning, analysis of media availability in independent practicum activities for elementary science learning, analysis of the benefits of the Practical E-Guidebook for science in practicum activities independent Elementary School Science Learning, analysis of the need for innovation in science practicum learning media. This research found that there was an average percentage of 82% with the majority of students stating that the Practical Science E-Guidebook needed to be developed so that the implementation of independent practical activities for students in elementary science learning courses could run in a structured manner and the preparation of reports could be well structured.

Keywords: ADDIE; Natural science; Practical e-guidebook

Introduction

Science learning is learning about knowledge that occurs due to a continuous, systematic, structured, objective, and rational process of observing natural phenomena and objects of a general nature in the form of a collection of results of classification, measurement, hypothesis, observation, time, data interpretation and experiments. using scientific methods with results in the form of facts, theories, principles, laws, concepts, and factors that explain natural phenomena (Jamaluddin et al., 2019; Sulthon, 2017). The science learning process is not only cognitive but includes processes, products, attitudes, and applications that must be carried out as a whole (Abdjul et al., 2022; Wahyuni, 2015). According to Mutvei and Mattsson (2015), science learning requires skills in searching for evidence and linking it to concepts. So to master science learning it is not enough to just listen or study through books or journals but is supported by learning activities that involve a process that produces products (Cavus & Alhih, 2014). One way is as stated by (Becker et al., 2019) namely by providing a direct experience of the learning process or what can be called practicum activities. Practical activities that train students in scientific processes and scientific attitudes (Subiantoro, 2016).

The scientific process is a skill for solving research problems in the form of scientific experiments such as identifying and defining variables, collecting and manipulating data (Juhji & Nuangchalerm, 2020). In

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addition, Kruea-In et al. (2015) stated that the scientific process has skills, namely manipulating materials, formulating hypotheses, designing investigations, drawing conclusions, and generalizations. Meanwhile, a scientific attitude consists of components of curiosity, respect for evidence and facts, critical thinking, perseverance, objectivity, creativity, honesty, and tolerance (Restami et al., 2013; Saputri et al., 2022). Practicum is also useful for training students' cognitive, affective, and psychomotor skills (Urip & Edy Mulyono, 2020). In the aspect of cognitive skills, that is interpreting theories that have been understood and developing them. In the aspect of affective skills, namely planning independent learning and learning to work together. In the psychomotor aspect, namely learning to install and use tools and materials in the practicum (Mustika & Hasby, 2022). Ioannidou et al. (2022) and Turiman et al. (2012) also explained the objectives of the science learning practicum, namely increasing understanding of scientific concepts, increasing interest and motivation, improving practical scientific attitudes regarding skills and abilities in solving problems, scientific thinking habits, and understanding of the nature of science.

Based on the results of interviews conducted with PGMI UIN Sunan Kalijaga Elementary School Science Learning lecturers, information was obtained that practicum activities are activities that support elementary school science learning. This practicum activity was carried out independently due to several reasons, namely limited tools, materials, and space because the PGMI laboratory was in the process of being repaired and time constraints because students were carrying out PPL activities at school. This independent practicum is carried out by making full use of the internet using tools, materials, and practicum guides, the results of which are in the form of practicum videos and practicum results reports. However, with this method, the implementation of practicums and the preparation of practicum reports are not well structured so lecturers experience problems in assessing the process, attitudes, and products of practicum activities. In carrying out practical science learning, students need laboratory equipment. For example, in the photosynthesis practicum that occurs in plants, students need a microscope, thermometer, beaker, glass funnel, measuring cup, etc. Apart from that, this independent practicum activity also requires a practicum design that can be carried out easily is integrated with technology, and can be used anywhere.

The solution that can be suggested to overcome this problem is to simplify the design of practical activities in terms of tools and materials as well as practical guidebooks that support the use of technology. One alternative is a technology-based practicum guidebook. According to Field (Chiew et al., 2019; Hasbiyati et al., 2022), e-books are a combination of images, videos, and sounds designed through software editing so that interaction occurs between the book and students. This interaction will help students understand the concept of knowledge. (Kaushamalika & Weerakoon, 2020) stated that e-books have a more efficient effect than printed books in increasing students' interest in learning. Apart from that, e-books can increase the effectiveness of learning carried out independently (Sun & Pan, 2021). Salleh & Yamat, (2021) state that e-books offer a variety of learning situations so that they can (Phadung & Dueramae, 2018) increase independent learning and provide interaction experiences between students and the media, besides improving students' logical thinking and integration abilities and allowing students to learn. using his five senses. (Phadung & Dueramae, 2018; Septiana et al., 2023) show that e-books are an animated medium that allows students to understand abstract concepts. This e-book is a learning media phenomenon that is easily accessible to students to understand concepts or phenomena that will facilitate and improve investigative abilities (Lin et al., 2017; Susanti et al., 2021).

Based on this, so that the practicum runs in accordance with the practicum objectives and practicum concepts that support independent practicum activities, students need to be supported with a Science Practicum E-Guidebook. The Science Practicum E-Guidebook is a guide to practicum activities as well as a guide to preparing the results of digital-based practicum activities. The design of the Practical Science E-Guidebook takes into account several things such as the availability of tools and materials as well as ease of use independently and ease of use anywhere. So, it is necessary to conduct needs analysis research to determine the need for developing a Practical Science E-Guidebook for UIN Sunan Kalijaga students.

Method

This research uses the research and development (R&D) method which is a systematic study of analyzing, designing, developing, and evaluating instructional programs, processes, and products (Gustini et al., 2023; Nabayra, 2023). The research and development (R&D) model used is ADDIE (Analyze, Design, Development, Implementation, and Evaluation) (Spatioti et al., 2022) at the analysis stage. The goal of the Analyze stage is to identify and analyze performance gaps. The Analyze stage according to (Branch, 2009) Validate the performance gap, Determine instructional goals, Analyze learners, Audit available resources, Recommendations for potential delivery systems

(recommend potential delivery), and Develop a project management plan (compose a project management plan). The following is the ADDIE research flow in the Analyze stage.

The data collection techniques used in this research were questionnaires and interviews. The interview technique used in this research was a structured interview with an open approach. Interviews were conducted with semester 6 lecturers in the Elementary Science Learning course at PGMI UIN Sunan Kalijaga. Meanwhile, the questionnaire in this study used a closed questionnaire, namely statements or questions for which alternative answers were provided (Sugiyono, 2019). This questionnaire was given to 30 6th-semester students who took the Elementary Science Learning course at PGMI UIN Sunan Kalijaga. The indicators analyzed in this research are analysis of independent practicum activities for elementary science learning, analysis of tools and materials in the laboratory in independent practicum activities for elementary science learning, analysis of media availability in independent practicum activities for elementary science learning, analysis of the benefits of the Practical E-Guidebook for science in practicum activities independent Elementary School Science Learning, analysis of the need for innovation in science practicum learning media. Data analysis was carried out using qualitative and quantitative analysis techniques. Qualitative data was obtained from interviews conducted with lecturers. Quantitative data was obtained from a student needs questionnaire using the Linkert scale. The Linkert scale is used to measure attitudes, perceptions, and opinions in a group or individual about the design or product to be developed (Maryuliana et al., 2016; Sugiyono, 2019). The Linkert scale used in this research is scale one stating strongly disagree, scale two stating disagree, scale three stating agree, scale four stating strongly agree. The data description is presented in the form of an average percentage which is interpreted based on the average percentage category in Table 1.

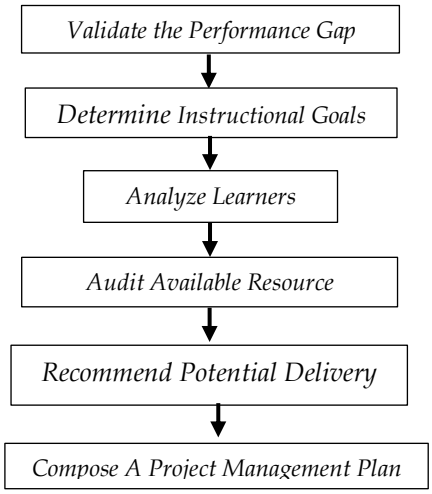

Figure 1. ADDIE Research Flow Phase Analysis (Branch, 2009).

Table 1. Average Percentage Category

Percentage	Category
0 – 1,9	Not needed
2 – 25,9	A small number require it
26 - 49,9	Less than half need it
50	Half of them need it
50,1 - 75,9	More than half need it
76 - 75,9	Most need it
100	Everyone need it

(Wati et al., 2020).

Findings and Discussion

ADDIE research is development research that can be carried out on developing learning models, learning media, learning methods, teaching materials and learning approaches (Gustini et al., 2023; Puspasari, 2019). This research uses ADDIE research at the Analysis stage. The stages of ADDIE research on analysis are validating the performance gap, determining instructional goals, analyzing students, auditing available resources, recommending potential delivery systems, develop a project management plan (Branch, 2009).

Analysis of the need for practical science e-guidebook products for PGMI UIN Sunan Kalijaga students was carried out in accordance with the Analyze stage procedures for research methods and development of the ADDIE model. Needs analysis is an initial study carried out to determine whether the results of media development will be optimally beneficial for individuals who need it or not (Nasrulloh & Ismail, 2017). So the aim of this research is to identify things that students or lecturers need in learning science in independent practicum activities. This needs analysis was obtained based on information from questionnaires or FGD (Focus Group Discussion) between lecturers and

students. The information obtained contains learning, learning media used, validity aspects, learning tools and materials, learning strategies, learning models, and student characteristics (Islamiyati et al., 2021; Yulia et al., 2023).

Validate the Performance Gap

The Validate the Performance Gap procedure functions to find problems in the field through a questionnaire. The questionnaire given to 6th-semester students of PGMI UIN Sunan Kalijaga showed results (Table 2).

Table 2. Student Responses regarding Independent Practicum Activities for Elementary School Science Learning

Statement	Rating			
	SS	S	TS	STS
Independent practical activities are carried out to verify the correctness of the concepts and theories that have been presented previously in lectures	26	63	11	0
This independent practicum activity trains real problem-solving strategies in everyday life	29	71	0	0
Independent practicum activities begin by providing problems related to the environment and daily life and solutions through independent practicum activities	37	61	2	0
Practical activities begin with students searching for practical procedures independently	29	69	2	0
Independent practical activities begin with students looking for tools and materials that are in accordance with the practical procedures they are looking for independently	33	63	4	0

Based on table 2, there are aspects of implementing practical activities, namely that 26% of students strongly agree, 63% agree, and 11% disagree that independent practical activities are carried out to verify the correctness of concepts and theories that have been previously presented in lectures; there are 29% of students strongly agree, 71% of students agree, that this independent practicum activity trains real problem solving strategies in everyday life; there are 37% of students strongly agree, 61% of students agree, and 2% of students disagree that independent practicum activities begin by providing problems related to the environment and daily life and solutions through independent practicum activities; there are 29% of students strongly agree, 69% agree, and 2% of students disagree that practicum activities begin with students looking for practicum procedures independently; 33% of students strongly agree, 63% agree, and 4% disagree that independent practicum activities begin with students looking for tools and materials that are in accordance with the practicum procedures they are looking for independently. The average percentage result for these 5 statements is 80% so it is included in the category of strongly agreeing that in independent practicum activities students are free to look for procedures and materials for independent practicum activities except for the problems and strategies that will be carried out in the independent practicum activities.

Table 3. Student Responses to Tools and Materials in the Laboratory in Independent Practicum Activities for Elementary School Science Learning

Statement	Rating			
	SS	S	TS	STS
Generally, practicum cannot be carried out because it requires a laboratory	33	67	0	0
The science learning practicum is carried out independently so that tools and materials are sought independently	25	75	0	0

Based on student responses regarding tools and materials in the laboratory in the Elementary School Science Learning Independent Practicum Activities, table 2 shows that 33% of students strongly agree, 67% of students agree that in general practicum cannot be carried out because it requires a laboratory and 25% of students strongly agree and 75% agreed that the science learning practicum was carried out independently so that tools and materials were sought independently. Based on these results, a percentage of 81% was obtained so that the 2 statements received the strongly agree category.

Table 4. Student Responses to Media Availability in Independent Practicum Activities for Elementary School Science Learning

Statement	SS	S	TS	Rating STS
The implementation of science learning practicum activities is less structured because there is no practicum manual	25	73	2	0
The implementation of science learning practicum is difficult to understand because the learning media does not support it	22	74	4	0

For the aspect of media availability in Elementary Science Learning Independent Practicum Activities (table 3), 25% of students strongly agree, 73% agree, and 2% of students disagree that the implementation of science learning practicum activities is less structured because there is no practicum manual; There are 22% of students strongly agree, 74% of students agree, and 4% of students disagree that the implementation of science learning practicum is difficult to understand because the learning media does not support it. Based on these results, a percentage of 79% was obtained so that these 2 statements received the strongly agree category. So, it can be concluded that there is no practicum manual and the learning media for practicum activities does not support it so practicum activities are less structured.

Determine instructional goals

This procedure functions to describe the objectives of developing learning media as a solution to problems that have been found in the field. This objective was determined through a questionnaire addressed to students with the results described in Table 5.

Table 5. Benefits of Practical Science E-Guidebooks in Elementary School Science Learning Independent Practicum Activities

Statement	SS	S	TS	Rating STS
Practical Science E-Guidebook can improve students' understanding and mastery of science concepts	30	62	8	0
Practical Science E-Guidebook helps students understand the process of independent practical activities	39	61	0	0
Practical Science E-Guidebook helps students in compiling practical activity reports	16	80	4	0

Based on this table, it can be seen that there are 30% of students strongly agree with the benefits of the Science Practical E-Guidebook, 62% agree, and 8% of students disagree, that the Science Practical E-Guidebook can increase understanding and mastery of science concepts. In understanding the concept, 39% of students strongly agreed, and 61% agreed that the Science Practical E-Guidebook could help students understand the process of independent practical activities.

Then in preparing the report results, there were (16%) of students strongly agreed, 80% agreed, and 4% disagreed that the Science Practical E-Guidebook helped students in compiling the results of practical activity reports. So, an average percentage of 88% was obtained so that the category of strongly agreeing was that the Practical Science E-Guidebook in independent elementary science learning practicum activities provided good benefits for students.

Table 6. The need for innovation in science practicum learning media

Statement	SS	S	TS	Rating STS
The Science Practical E-Guidebook is designed digitally to make it easier to use for independent practical activities	37	59	4	0
Practical Science E-Guidebook with digital design is more attractive for independent practical activities	36	64	0	0
A Practical Science E-Guidebook is needed as a practical guide for Elementary School Science Learning	37	61	2	0

In student responses regarding the need for innovation in science practicum learning media, the results showed that 37% strongly agreed, 59% agreed, and 4% disagreed that the Science Practical E-Guidebook was designed digitally to make it easier to use for independent practicum activities; 36% of students strongly agreed, 64% agreed that the Practical Science E-Guidebook with digital design was more

attractive for independent practical activities; There are 37% of students strongly agree, 61% agree, and 2% disagree that a Practical E-Guidebook for Science is needed as a practical guide for Elementary School Science Learning. Based on these results, a percentage of 82% was obtained so that the 3 statements received the strongly agree category.

Based on the results of the questionnaire analysis, it was found that the objectives of the Practical E-Guidebook in Science for PGMI UIN Sunan Kalijaga students are: 1) Practical E-Guidebook in Science can make it easier for students to carry out independent practicum activities, 2) Practical E-Guidebook in Science with a digital-based design can attract students in independent practicum activities, 3) Practical E-Guidebook Science can improve students' understanding and mastery of science concepts, 4) Practical E-Guidebook Science helps students understand the process of independent practicum activities, 5) Practical E-Guidebook Science helps students in compiling results practical activity report.

Analyze Learner

At the Analyze Learner stage, research carries out a needs analysis procedure to determine initial knowledge, learning experience, number of students, location of students, general and specific characteristics such as skills that aim at success in learning. At this stage, the researchers got the results, that is, the study sample was 30 sixth-semester students, most of whom were from Yogyakarta province. Students have devices that support learning such as tabs, smartphones, and laptops. So, students who take elementary science learning courses in independent practicum activities and with digital-based practicum media, namely the Practical E-Guidebook, have fulfilled the initial requirements. Apart from that, students in the 6th semester receive elementary science learning courses which previously received basic science and advanced science courses so that the initial competencies possessed by students are considered to have met the requirements for elementary science learning courses which include independent practicum activities.

Audit Available Resource

This stage is a stage that functions to recognize the readiness of teaching materials or learning resources to support the learning activities found in the previous stage. The teaching materials or teaching resources used to support practical activities carried out independently in elementary science learning are learning videos, PPTs, and papers that have been prepared by students and reference books such as Teaching Science Through Discover (6th Ed) by Carin and Sund, Principles of Instructional Design by Gagne and Briggs, Methods Toward a Science of Behavior and Experience by Ray, and Elementary Science Learning by Samatowa.

Recommend Potential Delivery Systems

The Recommend Potential Delivery Systems stage is a stage that functions to describe a solution that can be implemented in developing teaching materials that can be implemented related to the problem. At this stage, a conclusion will be drawn about the type of teaching materials that will be developed. Based on the stages that have been carried out, it can be concluded that the practical manual that will be developed should be digital-based so that it can be used by students independently. So the practicum guide developed in this research is the Science Practical E-Guidebook, which is a digital-based guidebook equipped with practicum procedures, practicum steps, practicum procedure videos, and procedures for writing practicum report results.

Compose A Project Management Plan

The Compose a Project Management Plan stage is the stage for designing stages for developing the Science Practical E-Guidebook. The stages that will be carried out in developing the Practical E-Guidebook Science media are: 1) collecting elementary science learning materials, 2) designing tools and materials and practical steps, 3) compiling practical materials, 4) designing practical activity steps in each material, 5) insert video procedures or practical steps into the Science Practical E-Guidebook, 6) create materials for preparing practical report results.

Based on the results of development research in analyzing the need for Practical Science E-Guidebooks for PGMI UIN Sunan Kalijaga students, it can be seen that this research involved lecturers and 6th semester students. These 6th semester students received elementary science learning courses which included practical activities. The practicum activities carried out by semester 6 students were carried out independently due to several reasons, namely the students' limited time, because they were implementing the PPL program at school and the laboratory owned by PGMI UIN Sunan Kalijaga was in the process of being repaired. Therefore, students are instructed to prepare practical tools and materials. Apart from that, students also look for practical steps and procedures independently. The solution to support independent practicum implementation activities in Science Practicum Learning is by creating an innovative method for developing digital-based practicum instructions called the Science Practical E-Guidebook.

In research conducted by Nurmalisa et al. (2023) found that learning with a digital-based approach can improve learning styles and increase the learning experience that will be obtained. Based on this research, it can be proven that digital-based media can increase learning experiences and improve learning so that it can support independent practicum activities carried out by students. Apart from that, research on the development of e-book media for practicum instructions conducted by Mawarni & Muhtadi (2017) showed that students could be successful in producing a product through understanding and applying concepts. The results of this research can illustrate that e-books can be used as learning media and guidelines for carrying out a procedure. So that it can strengthen this development research that the Practical E-Guidebook for Science can function as a guide in implementing independent elementary science learning practicum activities well.

Other research was also carried out by Martha, Z.D., Eka, P.A., Yerry (2018) which showed that e-books can help students study outdoors without time limits and can be done via smartphone. This can support the development of the Science Practical E-Guidebook for students who carry out practical activities independently so that this media can make things easier for students because the Science Practical E-Guidebook can be used anywhere and at any time. Likewise in research conducted by Aswin et al. (2018) regarding research on e-book development in Ecology courses in local potential research. In this research, the results showed that the material contained in e-books can be contextual and local things that will support students in activities in authentic Ecology learning courses. So that research into the development of the Practical Science E-Guidebook can take the form of things that are contextual based on the surrounding environment, such as using tools and materials that are local and easy to find in the surrounding environment.

Based on this, the Practical Science E-Guidebook is expected to help and make it easier for students to carry out elementary school science learning practicum activities. So that 6th semester students of PGMI UIN Sunan Kalijaga can carry out independent practicum activities well and in a structured manner.

Conclusion

The results of development research using the ADDIE method in the Analyze stage regarding the analysis of needs for developing a Practical E-Guidebook in Science for UIN Sunan Kalijaga students can be concluded that there is an average percentage of 82% of students who state that the Practical E-Guidebook in Science needs to be developed in order to carry out independent practical activities for students in elementary science learning courses, it can run in a structured manner and the preparation of reports can be well structured.

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In this research, the article was written by four authors, namely Ririn Hestiningtyas as the first author, Dr. Woro Sri Hastuti., S.Pd., M.Pd. as author two, Dr. Setiawan Edi Wibowo., S.Pd., M.Pd. as author of three, and Dr. Sigit Prasetyo, S.Pd.I., M.Pd.Si. as author of four. The author's contribution to this research is divided into several tasks, namely conceptualization carried out by authors one and four, methodology carried out by authors one and four, software facilitated by author one, instrument validation carried out by authors two, three and four, formal analysis carried out by the author one and four, investigation carried out by author one, resources facilitated by author four, data curation carried out by author one, writing and original draft carried out by author one, writing and editing carried out by author one, visualization carried out by author one, supervision carried out by author four, project administration was carried out by authors two and four, and funding acquisition was carried out by author one.

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References

Abdjul, T., Katili, N., Kurniasari, S., & Yunus, M. (2022). Effect of the Application of PhET-Assisted Ryleac Model on Students' Science Process Skills. *Jurnal Penelitian Pendidikan IPA*, *8*(5), 2216–2223. https://doi.org/10.29303/jppipa.v8i5.2235

Aswin, P., Irawati, M. H., & Saptasari, M. (2018). Persepsi Mahasiswa Biologi Terhadap Pengembangan Ebook Berbasis Penelitian Potensi Lokal Untuk Matakuliah Ekologi Program Studi Pendidikan Biologi Universitas Bengkulu. *Prosiding Semnas Pendidikan Biologi,* 137–140. Retrieved from https://jurnalfkip.unram.ac.id/index.php/SemnasBIO/article/view/691

Becker, E. S., Waldis, M., & Staub, F. C. (2019). Advancing student teachers' learning in the

teaching practicum through Content-Focused Coaching: A field experiment. *Teaching and Teacher Education*, *83*, 12–26. https://doi.org/10.1016/j.tate.2019.03.007

Branch, R. M. (2009). Instructional design models. *Handbook of research on educational communications and technology*, 77-87. https://doi.org/10.1007/978-1-4614-3185-5_7

Cavus, N., & Alhih, M. S. (2014). Learning Management Systems Use in Science Education. *Procedia - Social and Behavioral Sciences*, *143*, 517–520. https://doi.org/10.1016/j.sbspro.2014.07.429

Chiew, A., Leong, H., Jafre, M., Abidin, Z., & Saibon, J. (2019). Learners' Perceptions of the Impact of Using Digital Storytelling on Vocabulary Learning. *Teaching English with Technology*, *19*(4), 3–26. Retrieved from https://www.ceeol.com/search/article-detail?id=803686

Gustini, H., Ruhiat, Y., & Nulhakim, L. (2023). Development of Nearpod-Based Interactive Learning Media on Environmental Pollution Materials. *Jurnal Penelitian Pendidikan IPA*, *9*(3), 1314–1319. https://doi.org/10.29303/jppipa.v9i3.3061

Hasbiyati, H., Haque, A., & Afidati, N. I. (2022). Students' Scientific Attitude in Science Learning Using Discovery Learning-Based Environmental Pollution Digital Book. *Jurnal Penelitian Pendidikan IPA*, *8*(4), 2181–2187. https://doi.org/10.29303/jppipa.v8i4.1975

Ioannidou, O., Finch, K., & Erduran, S. (2022). Secondary teachers' views about teaching and assessing the diversity of scientific methods in practical science. *Journal of Education for Teaching*, *48*(5), 592–608. https://doi.org/10.1080/02607476.2021.2006572

Islamiyati, A. D., Sugiharto, B., & Prayitno, B. A. (2021). Needs Analysis of Teaching Materials Biology Learning Strategy. *Jurnal Penelitian Pendidikan IPA*, *7*(SpecialIssue), 340–344. https://doi.org/10.29303/jppipa.v7ispecialissue.1194

Jamaluddin, J., Jufri, A. W., Ramdani, A., & Azizah, A. (2019). Profil Literasi Sains Dan Keterampilan Berpikir Kritis Pendidik Ipa Smp. *Jurnal Penelitian Pendidikan IPA*, *5*(1). https://doi.org/10.29303/jppipa.v5i1.185

Juhji, J., & Nuangchalerm, P. (2020). Interaction between scientific attitudes and science process skills toward technological pedagogical content knowledge. *Journal for the Education of Gifted Young Scientists*, *8*(1), 1–16. https://doi.org/10.17478/jegys.600979.XX

Kaushamalika, P. K. M., & Weerakoon, W. R. W. M. A. U. (2020). Students' satisfaction with library services and facilities at three regional center libraries of the Open University of Sri Lanka. *Journal of the University Librarians Association of Sri Lanka*, *23*(1), 37. https://doi.org/10.4038/jula.v23i1.7965

Kruea-In, C., Kruea-In, N., & Fakcharoenphol, W. (2015). A Study of Thai In-Service and Pre-Service Science Teachers' Understanding of Science Process Skills. *Procedia - Social and Behavioral Sciences*, *197*, 993–997. https://doi.org/10.1016/j.sbspro.2015.07.291

Lin, M. H., Chen, H. C., & Liu, K. S. (2017). A study of the effects of digital learning on learning motivation and learning outcome. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(7), 3553–3564. https://doi.org/10.12973/eurasia.2017.00744a

Martha, Z.D., Eka, P.A., Yerry, S. (2018). Ebook Berbasis Mobile Learning. *KTP: Jurnal Kajian Teknologi Pendidikan, 1*(2), 109-114. Retrieved from http://journal2.um.ac.id/index.php/jktp/article/view/3705

Maryuliana, Subroto, I. M. I., & Haviana, S. F. C. (2016). Sistem Informasi Angket Pengukuran Skala Kebutuhan Materi Pembelajaran Tambahan Sebagai Pendukung Pengambilan Keputusan Di Sekolah Menengah Atas Menggunakan Skala Likert. *Jurnal Transistor Elektro Dan Informatika*, *1*(2), 1–12. Retrieved from https://jurnal.unissula.ac.id/index.php/EI/article/view/829

Mawarni, S., & Muhtadi, A. (2017). Pengembangan digital book interaktif mata kuliah pengembangan multimedia pembelajaran interaktif untuk mahasiswa teknologi pendidikan. *Jurnal Inovasi Teknologi Pendidikan*, *4*(1), 84. https://doi.org/10.21831/jitp.v4i1.10114

Mustika, D., & Hasby, H. (2022). Need Analysis of Basic Chemistry Practicum Based on Computation. *Jurnal Penelitian Pendidikan IPA*, *8*(4), 2337–2344. https://doi.org/10.29303/jppipa.v8i4.1987

Mutvei, A., & Mattsson, J.-E. (2015). Big Ideas in Science Education in Teacher Training Program. *Procedia - Social and Behavioral Sciences*, *167*, 190–197. https://doi.org/10.1016/j.sbspro.2014.12.661

Nabayra, J. N. (2023). Teacher-Made Videos as Learning Tool in Elementary Statistics during the Pandemic: A Developmental Research. *International Journal of Information and Education Technology*, *13*(1), 10–18. https://doi.org/10.18178/ijiet.2023.13.1.1774

Nasrulloh, I., & Ismail, A. (2017). Analisis kebutuhan pembelajaran berbasis ICT. *Jurnal PETIK*, *3*(1), 28–32. Retrieved from https://journal.institutpendidikan.ac.id/index.ph

p/petik/article/viewFile/355/359

Nurmalisa, Y., Sunyono, S., Yulianti, D., & Sinaga, R. M. (2023). An Integrative Review: Application of Digital Learning Media to Developing Learning Styles Preference. *International Journal of Information and Education Technology*, *13*(1), 187–194. https://doi.org/10.18178/ijiet.2023.13.1.1795

Phadung, M., & Dueramae, S. (2018). The Design and Impact of Interactive E-Book on Academic Language Achievement to Language Minority Students. *Journal of Physics: Conference Series*, *1097*(1). https://doi.org/10.1088/1742-6596/1097/1/012093

Puspasari, R. (2019). Pengembangan Buku Ajar Kompilasi Teori Graf dengan Model Addie. *Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang*, *3*(1), 137. https://doi.org/10.31331/medivesveteran.v3i1.702

Restami, M., Suma, K., & Pujani, M. (2013). Pengaruh Model Pembelajaran Poe (Predict-Observe-Explaint) Terhadap Pemahaman Konsep Fisika Dan Sikap Program Studi Pendidikan Sains , Program Pasca Sarjana. *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha*, *3*(1), 1–11. Retrieved from https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/716

Salleh, N. A., & Yamat, H. (2021). Motivating Struggling Malaysian Primary ESL Readers Through The "Read and Record Project." *Journal of English Language Teaching and Applied Linguistics*, *3*(1), 19–29. https://doi.org/10.32996/jeltal

Saputri, F., Rohaeti, E., Wiyarsi, A., & Ikhsan, J. (2022). Profile of Students' Scientific Attitudes Through Practicum Activities Using Student E-Worksheet Based Chemicals at Home. *Jurnal Penelitian Pendidikan IPA*, *8*(5), 2312–2318. https://doi.org/10.29303/jppipa.v8i5.2094

Septiana, R., Yulianti, E., & Nurcahyo, H. (2023). Development of Multiple Intelligence Based Interactive Ebook to Improve Critical Thinking Ability and Cognitive Learning Outcomes on an Excretory System. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 4265–4272. https://doi.org/10.29303/jppipa.v9i6.3286

Spatioti, A. G., Kazanidis, I., & Pange, J. (2022). A Comparative Study of the ADDIE Instructional Design Model in Distance Education. *Information (Switzerland)*, *13*(9), 1–20. https://doi.org/10.3390/info13090402

Subiantoro, A. (2016). Pentingnya Praktikum Dalam Pembelajaran IPA. *PPM "Pelatihan Pengembangan Praktikum IPA Berbasis Lingkungan,"* 1–11.

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alphabet.

Sulthon, S. (2017). Pembelajaran IPA yang Efektif dan Menyenangkan bagi Siswa MI. *ELEMENTARY: Islamic Teacher Journal*, *4*(1). https://doi.org/10.21043/elementary.v4i1.1969

Sun, L., & Pan, C. E. (2021). Effects of the Application of Information Technology to E-Book Learning on Learning Motivation and Effectiveness. *Frontiers in Psychology*, *12*(September), 1–5. https://doi.org/10.3389/fpsyg.2021.752303

Susanti, D., Fitriani, V., & Sari, L. Y. (2021). Curriculum and Student Analysis of Interactive Electronic Book Based on Project in Strategy and Design of Learning Subject. *Jurnal Penelitian Pendidikan IPA*, *7*(3), 344. https://doi.org/10.29303/jppipa.v7i3.684

Turiman, P., Omar, J., Daud, A. M., & Osman, K. (2012). Fostering the 21st Century Skills through Scientific Literacy and Science Process Skills. *Procedia - Social and Behavioral Sciences*, *59*, 110–116. https://doi.org/10.1016/j.sbspro.2012.09.253

Urip, U., & Edy Mulyono, S. (2020). Implementation of SAVI Learning Model Through Practicum Activities Towards Students Science Learning Outcomes Article Info. *Journal of Primary Education*, *9*(2), 181–187. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpe/article/view/30930

Wahyuni, S. (2015). Pengembangan Petunjuk Praktikum Ipa Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Smp. *Jurnal Pengajaran Matematika Dan Ilmu Pengetahuan Alam*, *6*(1), 196. https://doi.org/10.18269/jpmipa.v20i2.585

Wati, I. F., Yuniawatika, Y. Y., & Murdiyah, S. (2020). Analisis Kebutuhan Terhadap Bahan Ajar Game Based Learning Terintegrasi Karakter Kreatif. *Jurnal Pendidikan Karakter*, *10*(2). https://doi.org/10.21831/jpk.v10i2.31880

Yulia, E., Riadi, S., & Nursanni, B. (2023). Validity of Interactive Multimedia on Metal Coating Learning Developed Using the ADDIE Model. *Jurnal Penelitian Pendidikan IPA*, *9*(5), 3968–3974. https://doi.org/10.29303/jppipa.v9i5.3772