Preliminery Research Phase Analysis as a Basis for Developing a Plant Morphology Practical Guidebook Based on a Scientific Approach

Nurul Fauziah[1*]; Sepita Ferazona[2]; Dea Sulistiawati[3]

[1,2,3]Department of Biology Education, Universitas Islam Riau, Indonesia
[1]Corresponding Email: fauziahnurul@edu.uir.ac.id, Phone Number: 0852 xxxx xxxx*

Article History:
Received: Dec 03, 2023
Revised: Feb 15, 2024
Accepted: Feb 22, 2024
Online First: Mar 16, 2024

Keywords:
Plant Morphology, Practical Guide Book, Scientific Approach.

Kata Kunci:
Buku Petunjuk Praktikum, Morfologi Tumbuhan, Pendekatan Saintifik.

How to cite:
Fauziah, N., Ferazona, S., & Sulistiawati, D. (2024). Preliminery Research Phase Analysis as a Basis for Developing a Plant Morphology Practical Guidebook Based on a Scientific Approach. *Edunesia : Jurnal Ilmiah Pendidikan*, *5*(2), 640-.651.

Abstract: This research was motivated by problems in practicum activities that the researcher found as a lecturer teaching plant morphology courses, one of which was that the plant morphology practicum did not have a practicum manual that was able to hone students' science process skills. The aim of this research is to describe preliminery research phase data obtained as a basis for developing a plant morphology practicum guidebook based on a scientific approach. This type of research is development research using the Plomp development model, the research only reached the first stage, namely the preliminery research phase. The number of sampels in this study was 96 biology education students at FKIP UIR. The research instruments are RPS analysis sheets, interview sheets, observation sheets, problem and needs questionnaires. The results of the research revealed that from the RPS analysis there were 6 topics that would be put into practice, 10.83% state the practical guidebook was not based on a scientific approach, and based on the needs questionnaire, 100% of students agreed that it was necessary to develop a plant morphology practical guidebook based on a scientific approach. It can be concluded that based on preliminery research phase data, it is necessary to develop a practical guidebook for plant morphology based on a scientific approach. The expected implication of this research is that after the plant morphology practicum manual based on a scientific approach passes tests of validity, practicality and effectiveness, that can improve practicum learning outcomes and hone students' science process skills.

Abstrak: Penelitian ini dilatarbelakangi oleh permasalahan dalam kegiatan praktikum yang ditemukan peneliti sebagai dosen pengampu mata kuliah morfologi tumbuhan, salah satunya praktikum morfologi tumbuhan belum memiliki buku petunjuk praktikum yang mampu mengasah keterampilan proses sains mahasiswa. Tujuan penelitian ini adalah untuk mendesripsikan data *preliminery research phase* yang didapatkan sebagai dasar pengembangan buku petunjuk praktikum morfologi tumbuhan berbasis pendekatan saintifik. Jenis penelitian ini adalah penelitian pengembangan menggunakan model pengembangan Plomp, pada penelitian hanya sampai pada tahap pertama yaitu *preliminery research phase*. Jumlah sampel pada penelitian ini adalah 120 orang mahasiswa pendidikan biologi FKIP UIR. Instrumen penelitian berupa lembar analisis RPS, lembar wawancara, lembar observasi, angket permasalahan dan kebutuhan mahasiswa. Hasil penelitian mengungkapkan dari analisis RPS terdapat 6 topik yang akan dipraktikumkan, 10.83% menyatakan buku petunjuk praktikum belum berbasis pendekatan saintifik, serta berdasarkan angket kebutuhan 100% mahasiswa setuju perlu dikembangkannya buku petunjuk praktikum morfologi tumbuhan berbasis pendekatan saintifik. Dapat disimpulkan bahwa berdasarkan data *preliminery research phase* perlu dilakukan pengembangan buku petunjuk praktikum morfologi tumbuhan berbasis pendekatan saintifik. Implikasi yang diharapkan dari penelitian ini adalah setelah buku petunjuk praktikum morfologi tumbuhan berbasis pendekatan saintifik melewati uji validitas, praktikalitas, dan efektivitas, maka bisa digunakan sebagai buku petunjuk praktikum yang dapat meningkatkan hasil belajar praktikum serta mengasah keterampilan proses sains mahasiswa.

https://doi.org/10.51276/edu.v5i2.794

A. Introduction

Education is a process that a person goes through in order to gain learning experience and develop all their potential (Wiska et al., 2020). The learning process at the Merdeka Campus is a manifestation of student-centered learning (Team FKIP UIR, 2021). The MBKM curriculum policy was implemented because the learning process in Indonesian tertiary institutions was deemed unable to fully produce graduates who were quick to respond to changes in the real world of work after the Covid-19 pandemic and were able to adapt to advances in technology and communication (Chelsya, 2022). The development of information technology provides an increase in job competency in accordance with needs, education in higher education as a means of creating quality human resources requires collaboration in various fields including the industrial/service sector (Laga et al., 2021). Teachers in creating a good learning atmosphere and learning process to get satisfactory learning outcomes is not necessarily easy, therefore learning in schools must be planned well so that learning can be useful (Susilawati et al., 2020). In order to create professional graduates according to the learning process on an independent campus, one of the things that requires the development of teaching materials is. Developing teaching materials can start from developing practical manuals.

The practicum manual is a book that contains directions for practicum activities which include procedures for preparation, implementation, analysis and reporting which aims to provide information to students in carrying out practicum with the aim of minimizing the risk of accidents that may occur (Fatony, 2017). In its implementation, practicum activities are adapted to the procedures, materials and tools contained in the practicum guide, in order to achieve basic competency in the subjects being practiced (Handayani et al., 2014). One of the subjects that requires practicum in the lecture process is the morphology course plant.

Plant morphology is one of the mandatory subjects in the FKIP UIR Biology Education study program which requires teaching materials in the lecture process. The plant morphology practicum manual is one of the teaching materials used to strengthen the concepts and theories obtained by students from the plant morphology lecture process.

Based on the results of the researcher's analysis of previous plant morphology practicum activities, several problems were found regarding the implementation of practicums in plant morphology courses. Some of the problems found include: first, the practicum guide has not directed students as practitioners to hone their science process skills. Second, the plant morphology practical guide that has been analyzed is still based on simple recipe book style instructions. Third, the lack of students' science skills causes the results of students' practicum cognitive competence to not be optimal and not to achieve the expected practicum activity goals. Fourth, there is still a lack of evaluation that refers to the learning objectives or competencies to be achieved. Fifth, practical activities focus more on results (products) and not on scientific processes. Sixth, the plant morphology practicum guide used does not have a specific approach (the approach is still implicit) which cannot hone students' science skills as practitioners. One effort that can be made to hone students'

https://doi.org/10.51276/edu.v5i2.794

science skills is through practicum activities supported by practicum guides based on a scientific approach. The practicum instructions are still very simple, making students less motivated to carry out practicums, because in the existing practicum instructions, there is no theoretical basis and columns for observation and discussion results. This simple practicum guide certainly makes students carry out practicum activities as simple as possible without following the rules of the scientific method. As a result, many students' practicum learning outcomes are still low and students' science skills are also still low, even though one of the competencies that biology education students must have is to have the competence to make observations in the laboratory based on how they work according to the rules of the scientific method. Therefore, it is necessary to have a plant morphology practicum manual based on a scientific approach for students, in order to improve practicum learning outcomes and hone students' science skills.

A practical guide based on a scientific approach is one that can hone students' abilities according to their level of thinking ability which contains the 5M principles (Kemdikbud, 2013). This is also in line with the results of research conducted on the development of scientific approach-based biology practicum guides for MTs/SMP and the results show an increase in cognitive, affective and psychomotor competencies through scientific work activities carried out by students (Roza, 2015). The development of this scientific approach-based plant morphology practicum guide using the Plomp model only reached the preliminary research phase (Plomp & Nieveen, 2013). Based on the background of this problem, research was carried out regarding the peliminery research phase analysis as a basis for developing a plant morphology practicum manual based on a scientific approach. This research aims in general to describe students' perceptions of the problems of implementing plant morphology practicum activities and the plant morphology practicum manuals used by students, while specifically aiming to describe the results of the preliminary research phase as a basis for developing plant morphology practicum practicum manuals based on a scientific approach.

B. Method

This type of research is development research using the Plomp development model which consists of three stages. In this research, we have only reached the first stage, namely the preliminary research phase. This research was conducted in the Biology Education study program, FKIP, Riau Islamic University for 3 months from August to October 2023. The subjects of this research were biology education students, FKIP UIR, who had completed the plant morphology course. The number of samples in this study was 120 people and 2 lecturers who taught plant morphology courses. The sampling technique uses saturated samples. The research instruments were curriculum analysis sheets in the form of RPS analysis, lecturer and student interview sheets, lecture observation sheets for plant morphology courses, problem questionnaires in plant morphology courses, and student needs questionnaires for scientific approach-based plant morphology manuals.

https://doi.org/10.51276/edu.v5i2.794

The data analysis technique in this research uses quantitative descriptive. According to (Sastroadmojo, 2018) to analyze the questionnaire that has been obtained, the researcher changes the data in percentage form using the percentage formula, namely:

$$P = \frac{F}{N} x\ 100\%$$

Information:
P = the percentage sought
F = frequency of answers
N = number of samples

The following is the research flow which can be seen in Figure 1.

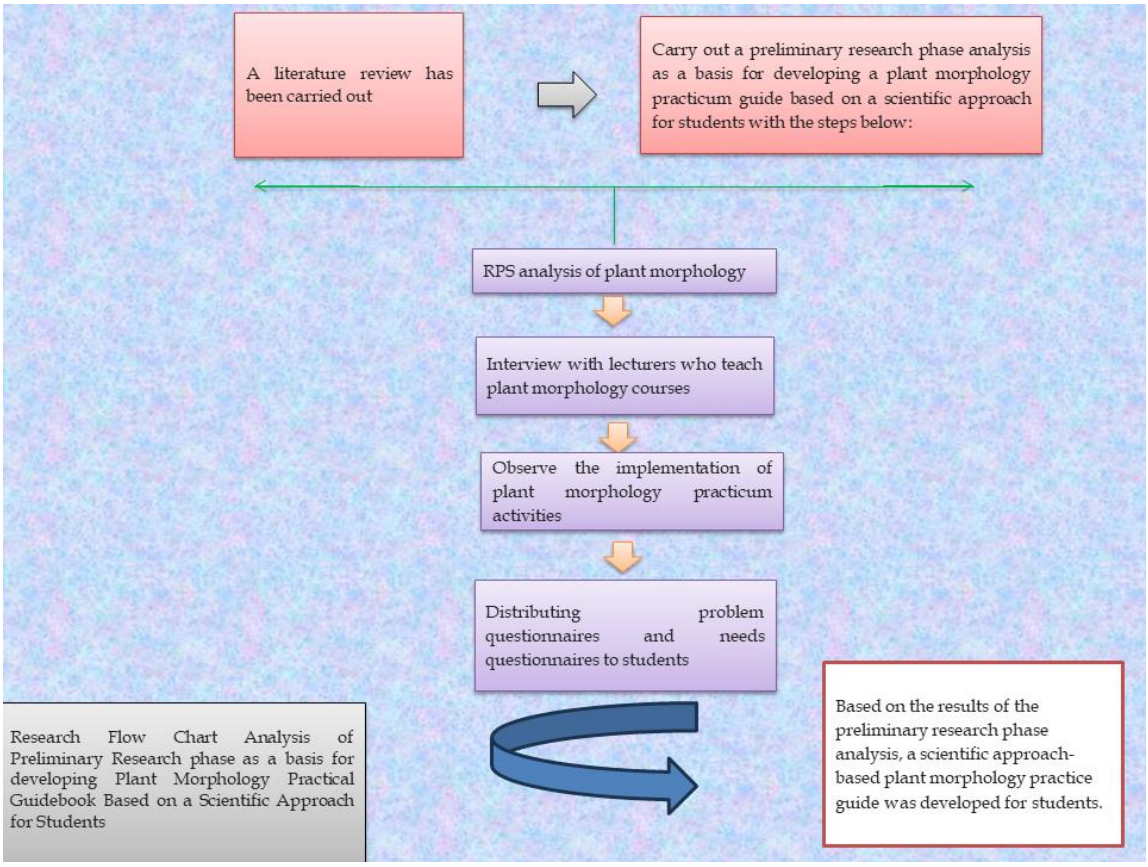

Figure 1. Research Flow Chart

C. Result and Discussion

Result

The preliminary research phase is the initial stage in the Plomp model for developing a practical manual for plant morphology based on a scientific approach. The preliminary research phase stages that have been carried out include:

https://doi.org/10.51276/edu.v5i2.794

Analysis of the Semester Learning Plan (RPS) Plant Morphology

Based on the RPS analysis of the plant morphology course that has been carried out, the following six practical topics were obtained:

Table 1. Topics Practiced

Number	Topics Practiced
1.	Root plant organs
2.	Stem plant organs
3.	Leaf plant organs
4.	Flower plant organs
5.	Fruit plant organs
6.	Seed plant organs

Results of Interviews with Lecturers in Plant Morphology Courses

Based on the results of interviews with lecturers who teach plant morphology courses, it was found that the plant morphology practicum activities carried out in the laboratory already had practical instructions, but were still in the form of a simple recipe book, and were not equipped with a theoretical basis and supporting pictures. Students also make reports on practical activities on another sheet of paper. Apart from that, the practicum instructions used are not optimal in honing students' science process skills because they do not have a scientific approach, and practicum activities are still focused on results rather than the scientific process.

Observation Results of Plant Morphology Practical Activities

Based on the results of observations regarding the implementation of plant morphology practicum activities that have been carried out, several problems were found as follows.

Table 2. Observation Results of Plant Morphology Practical Activities

No.	Problem
1.	The practicum instructions used previously did not direct students as practitioners to hone their science process skills.
2.	The plant morphology practical instructions that have been analyzed are still based on simple recipe book model instructions.
3.	The lack of students' science skills causes the results of students' practicum cognitive competence to not be optimal and not to achieve the expected practicum activity goals.
4.	There is still a lack of evaluation that refers to the learning objectives or competencies to be achieved.
5.	Practical activities focus more on results (products) and not on scientific processes.
6.	The plant morphology practical instructions used do not yet have a specific approach.

https://doi.org/10.51276/edu.v5i2.794

Results of Problem Questionnaires in Plant Morphology Practical Activities

The results of the problem questionnaire in plant morphology practicum activities can be seen in Table 3 below.

Table 3. Results of Problem Questionnaires in Plant Morphology Practical Activities

Number	Statement	Percentage
1.	Appearance	25%
2.	Contents	30%
3.	Language	80%
4.	Have an scientific approach	10%

Results of the Needs Questionnaire in Plant Morphology Practical Activities

The results of the needs questionnaire in plant morphology practicum activities can be seen in Table 4 below.

Table 4. Results of the Needs Questionnaire in Plant Morphology Practical Activities

Number	Statement	Percentage
1.	Appearance	98%
2.	Contents	98%
3.	Language	100%
4.	Saintific approach	100%

Discussion

The preliminary research phase is the first stage of the Plomp development model. In the preliminary research phase, several steps were carried out as a basis for developing a plant morphology practicum manual based on a scientific approach, including: analysis of RPS for plant morphology courses to determine topics to be practiced, interviews with lecturers in charge of plant morphology courses, observing the implementation of morphology practicums. plants, analyzing problem questionnaires and student needs questionnaires regarding the implementation of plant morphology practicum activities.

Analysis of the Semester Learning Plan (RPS) for the Plant Morphology Course

Based on the analysis of the Semester Learning Plan (RPS) for the plant morphology course that has been carried out, six practical topics were obtained, including plant organs, roots, stems, leaves, flowers, fruit and seeds. RPS analysis needs to be carried out to determine the topics that will be practiced so that the practical topics are in accordance with the theory studied in lectures. This is in line with the research results of Budiarti & Oka (2014) which stated that the first stage that needs to be carried out in developing a practicum guide is the definition stage which consists of field studies and literature studies by analyzing the content standards in the 2013 curriculum, so that they can determine the topics that will be practicable.

https://doi.org/10.51276/edu.v5i2.794

Analysis of Interview Results with Lecturers in Plant Morphology Courses

The results of interviews with lecturers in the plant morphology course also revealed that the plant morphology practicum activities carried out in the laboratory already had practical instructions, but were still in the form of a simple recipe book, and were not equipped with a theoretical basis and supporting pictures. Students also make reports on practical activities on another sheet of paper. Apart from that, the practicum instructions used are not optimal in honing students' science process skills because they do not have a scientific approach, and practicum activities are still focused on results rather than the scientific process. Based on this, it can be seen that plant morphology practicum activities have not honed students' science process skills, which are actually the main competencies that must be achieved in a practicum activity. Practical activities are still more focused on the final result, not the scientific process. This is in line with the results of research by Machin (2014) which states that scientific work is an emphasis on certain attitudes or values, such as avoiding dogmatism, being flexible, creative, honest, logical, open to criticism, thorough, loving duty and understanding risk. All of these values are the foundation of scientific work. If students are accustomed to being involved in scientific work, students will inherit these values and attitudes.

Analysis of Observation Results of Plant Morphology Practical Activities

The practicum instructions used previously did not direct students as practitioners to hone their science process skills. Plant morphology practicum activities have not honed students' science process skills, which is actually one of the main competencies that must be achieved in a practicum activity. During practicum activities, students immediately carry out observation activities without understanding the theoretical basis, objectives and benefits of the practicum activities carried out. Information regarding the aims and benefits of practicum is only conveyed verbally before the practicum begins. Students directly observed the plant objects they brought and made the results of their observations and it could also be seen that not all practitioners contributed to this activity. This is in line with the research results presented by Aprianti et al (2018) which stated that in practicum activities teachers do not have good enough practicum guides, so that during practicum activities the teacher only provides a piece of paper containing materials and work procedures. the rest is the teacher who explains in the laboratory. This has an impact on the practicum implementation process which causes students not to focus on the practicum being carried out and results in students not being able to link the results of the practicum with theory.

The plant morphology practicum instructions that have been analyzed are still based on simple recipe book model instructions, not yet in accordance with the teaching material standards set by the Dikti (2017) regarding guidelines for preparing learning tools and teaching materials. The plant morphology practical instructions used previously were not

https://doi.org/10.51276/edu.v5i2.794

equipped with a theoretical basis and supporting images. Apart from that, there are still many components in teaching materials that still don't exist, for example practicum rules, discussion columns for observation results, evaluations regarding the topics being practiced, as well as assessment components for observation results to determine practicum grades. This is in accordance with the research results of Arieska et al (2018) which states that practical instructions that use the recipe model are not optimal in developing students' science process skills and do not help much in developing students' thinking abilities.

The lack of students' science skills causes the results of students' practicum cognitive competence to not be optimal and have not achieved the expected practicum activity goals and there is still a lack of evaluation that refers to the learning objectives or competencies to be achieved, this is because the practicum instructions do not yet have a scientific approach. This is in line with the research results of Ristiyani & Dwi (2014) which stated that there was an increase in student learning outcomes due to learning through a scientific approach, because students were motivated to find answers to the problems contained in the LKS so that it would be easier to master the material.

The practicum instructions used still do not use a certain approach that should exist because it is very necessary in a practicum activity. Having a scientific approach will familiarize students with making observations through scientific steps and methods, so that it will develop students' science process skills. This is in line with the opinion of Rahmi (2014) who stated that there is a need for an approach that is in accordance with the 2013 curriculum so that practicum activities can be carried out well. One approach that is appropriate to the practical steps is the scientific approach. The characteristics of a scientific approach, namely observing, asking, collecting data, associating and communicating, are very suitable when applied in practicum.

Questionnaire Analysis of Problems in Plant Morphology Practical Activities

The appearance aspect of the plant morphology practicum instructions used previously received a percentage of 25%, this was because the practicum instructions were still in the form of a recipe book, had a monotonous type of writing, were not equipped with pictures that supported the topic to be practiced and had no color. This is supported by the research results of Fauziah (2018) which states that one aspect that needs to be considered in developing teaching materials is the technical aspect, in the form of teaching material components, presentation, writing and good color combinations that will increase students' learning motivation.

The content aspect of the plant morphology practicum instructions used previously received a percentage of 30%, this was because the practicum instructions were not equipped with rules, theoretical basis, objectives, benefits, scientific method steps, scoring method, and columns for assessing practicum results. This is in line with the research results of Sumarmin & Roza (2019) which stated that practicum objectives that have not been adjusted to the basic competency indicators for the material to be practiced, presenting incomplete information regarding the tools and materials used will result in students not

https://doi.org/10.51276/edu.v5i2.794

preparing the tools and materials completely. for practical needs, so that the implementation of practical activities will be disrupted.

The language aspect of the plant morphology practicum instructions used previously received a percentage of 92%, this is because the practicum instructions already have language that is communicative and easy to understand by students and is in accordance with the provisions of good and correct Indonesian language rules. Rahmawati et al (2013) also expressed the same thing that communicative language will make students understand the learning material.

The aspect of having a scientific approach to the plant morphology practicum instructions used previously received a percentage of 10%, this is because the practicum instructions do not yet have a scientific approach to how they work. Having a scientific approach to support practicum work will increase student competence, especially in honing science skills. This is in line with the opinion of Rahmi (2014) who stated that there is a need for an approach that is in accordance with the 2013 curriculum so that practicum activities can be carried out well.

Analysis of Needs Questionnaires in Plant Morphology Practical Activities

The appearance aspect of the plant morphology practicum manual based on a scientific approach that will be developed received a percentage of 98%, this shows that students agree that the practicum manual is equipped with pictures that support practicum activities, has colors that are dominated by green and white, and dominated by the Comic Sans MS and Footlight MT Light writing types. This is in line with the results of research by Rusiani & Lazulva (2017) which revealed that students like teaching materials that have attractive color designs and images so that students are interested in reading and studying them.

The content aspect of the plant morphology practicum manual based on a scientific approach that will be developed received a percentage of 98%, this shows that students agree that the practicum manual is equipped with a cover, foreword, instructions for use, rules, table of contents, table list, list of figures, theoretical basis, objectives, benefits, steps of the scientific method, scoring methods, and columns for assessing practical results. This is in accordance with the teaching material standards set by the Dikti (2017) regarding guidelines for preparing learning tools and teaching materials.

The language aspect of the plant morphology practicum manual based on a scientific approach that will be developed received a percentage of 100%, this shows that students agree that the practicum manual has language that is easy to understand and complies with the provisions of good and correct Indonesian language rules. This is supported by the results of research conducted by Fauziah et al (2021) which states that the linguistic aspect has components including: the language in teaching materials is appropriate to student development, communicative, dialogic, interactive, straightforward, has a coherent flow of thought, and language that in accordance with the rules of good and correct Indonesian.

https://doi.org/10.51276/edu.v5i2.794

Language that is easy to understand will make it easier for students to understand the material.

The aspect of the scientific approach in the scientific approach-based plant morphology practicum manual that will be developed gets a percentage of 100%, this shows that students agree with the practicum manual using the scientific approach model which consists of 5M, namely observing, asking, trying, reasoning and communicating. This was also expressed by Aswan et al (2018) that a scientific approach can improve critical thinking skills, increase knowledge, and increase students' understanding of concepts. Daryanto (2014) also revealed that there are characteristics in scientific learning, including involving scientific process skills in constructing concepts, laws or principles.

D. Conclusion

Based on the preliminary research phase data that has been obtained (plant morphology RPS analysis, interviews with lecturers who teach plant morphology courses, observations of the implementation of practical activities, and problem questionnaires and needs questionnaires that have been distributed to students who have taken plant morphology courses, it can be concluded that it is necessary to develop a practical manual for plant morphology based on a scientific approach.

The expected implication of this research is that after the plant morphology practicum manual based on a scientific approach passes tests of validity, practicality and effectiveness, it can be used as a practicum manual that can improve practicum learning outcomes and hone students' science process skills.

Further research will carry out validity tests, practicality tests and effectiveness tests on the scientific approach-based plant morphology practical manual that will be developed.

Acknowledgment

The author would like to thank the Department of Research and Community Service (DPPM) of Riau Islamic University for funding this research with a research contract budget for 2023. Research contract number (Number: 632/KONTRAK/P-PT/DPPM-UIR/06- 2023.

References

Aprianti, R., Kurniati, T., & Kurniawan, R. A. (2018). Pengembangan Penuntun Praktikum Kimia Berbasis Pendekatan Saintifik pada Materi Laju Reaksi untuk Siswa Kelas XI IPA di SMA Adisucipto Pontianak. *Ar-Razi Jurnal Ilmiah, 6*(1), 134-143. https://doi.org/10.29406/arz.v6i1.986

Arieska, M., Syamsurizal, S., & Sumarmin, R. (2018). Guiding Development Based Approach Practicum Vertebrates Taxonomy Scientific Study Program for Students of Biology Education. In *IOP Conference Series: Materials Science and Engineering, 335*(1), 1-7. IOP Publishing. https://doi.org/10.1088/1757-899x/335/1/012096

https://doi.org/10.51276/edu.v5i2.794

Aswan, D. M., Lufri, L., & Sumarmin, R. (2018). Influence of Problem Based Learning on Critical Thinking Skills and Competence Class VIII SMPN 1 Gunuang Omeh, 2016/2017. In *IOP Conference Series: Materials Science and Engineering, 335*(1), 1-7. IOP Publishing. https://doi.org/10.1088/1757-899x/335/1/012128

Budiarti, W., & Oka, A. A. (2017). Pengembangan Petunjuk Praktikum Biologi Berbasis Pendekatan Ilmiah (Scientific Approach) untuk Siswa Sma Kelas Xi Semester Genap Tahun Pelajaran 2013/2014. *BIOEDUKASI (Jurnal Pendidikan Biologi), 5*(2), 123-130. https://doi.org/10.24127/bioedukasi.v5i2.791

Chelsya, W. H. (2022). Persepsi Mahasiswa terhadap Kebijakan Kurikulum Merdeka Belajar Kampus Merdeka (MBKM). *YUME : Journal of Management, 5*(3), 387–401. https://doi.org/10.37531/yume.vxix.4547

Team FKIP UIR. (2021). *Kurikulum Pendidikan Tinggi (KPT) Program Studi Pendidikan Biologi FKIP UIR*. Riau: FKIP Biologi Press UIR.

Daryanto, D. (2014). *Pendekatan Pembelajaran Saintifik Kurikulum 2013*. Yogyakarta: Gava Media.

Fauziah, N. (2018). Validitas Penuntun Praktikum Biologi Umum Berbasis Pendekatan Saintifik untuk Mahasiswa. *Indonesian Biology Teachers, 1*(2), 42-45.

Fauziah, N., Iffa, I.I., and Gita, A.N. (2021). Development of a Biotechnology Module Containing Research Results for Biology Students. Bioconcetta Journal, Vol 7 No. 1 of 2021 Pages 1-9.

Fauziah, N., Putri, I. I., & Nevara, G. A. (2021). Development of a Biotechnology Module Containing Research Findings for Biology Students. *Bioconcetta Journal, 7*(1), 1-9.

Laga, Y., Nona, R. V., Langga, L., & Jamu, M. E. (2021). Persepsi Mahasiswa terhadap Kebijakan Merdeka Belajar Kampus Merdeka (MBKM). *Edukatif : Jurnal Ilmu Pendidikan, 4(*1), 699–706. https://doi.org/10.31004/edukatif.v4i1.1951

Machin, A. (2014). Implementation of the Scientific Approach, Character Planting and Conservation In Learning Growth Materials. *Journal of Indonesian Science Education, 3*(1), 28-35.

Dikti. (2017). Panduan Menyiapkan Alat Pembelajaran dan Bahan Ajar. Jakarta: Direktorat Jenderal Pendidikan Tinggi, Riset, dan Teknologi.

Fatony, M. Y. P. (2017). *Pengembangan Buku Petunjuk Praktikum Biologi SMA Kelas X dengan Pendekatan Kontekstual Berbasis Inkuiri Terbimbing*. Universitas Sanata Dharma Yogyakarta.

Plomp, T. & Nieveen, N. (2013). *Educational Design Research*. Enchede: Netherlands Institute for Curriculum Development.

https://doi.org/10.51276/edu.v5i2.794

Handayani, L. P., Farida, F., & Anhar, A. (2014). Pengembangan Buku Penuntun Praktikum IPA Berbasis Inkuiri Terbimbing untuk SMP Kelas VII Semester II. *Kolaboratif, 1*(3), 69-76.

Kemdikbud. (2013). *Pendekatan Ilmiah dalam Pembelajaran. Pelatihan Guru Dalam Rangka Penerapan Kurikulum 2013*. Bandung: Konsep Pendekatan Ilmiah.

Rahmawati, N. L., Sudarmin, S., & Pukan, K. K. (2013). Pengembangan Buku Saku IPA Terpadu Bilingual dengan Tema Bahan Kimia dalam Kehidupan sebagai Bahan Ajar di MTs. *Unnes Science Education Journal, 2*(1), 157-164.

Rahmi, M., & Sartika, R. P. (2014). Implementasi Pendekatan Scientific Berbasis Lesson Study dalam Praktikum Hukum Perbandingan Tetap. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK), 3*(7), 1-12.

Ristiyani, D., & Yulianti, D. (2014). Pengembangan LKS Fisika Materi Pemantulan dan Pembiasan Cahaya Terintegrasi Karakter dengan Pendekatan Saintifik. *UPEJ Unnes Physics Education Journal, 3*(3), 54-62. https://doi.org/10.15294/upej.v3i3.4321

Roza, RK (2015). *Pengembangan Panduan Praktikum Biologi Berbasis Pendekatan Saintifik untuk MTs/SMP Kelas VII Semester II*. Undergraduate Thesis. Padang: Universitas Negeri Padang.

Rusiani, A.F., & Lazulva. (2017). Pengembangan Penuntun Praktikum Titrasi Asam Basa Menggunakan Indikator Alami Berbasis Pendekatan Saintifik. *Jurnal Tadris Kimiya, 2*, 159-168.

Sastroadmojo, S. (2018). *Pengantar Statistik Pendidikan*. Jakarta: Rajawali press.

Sumarmin, R., & Roza, R. K. (2019). Pengembangan Penuntun Praktikum Biologi Berbasis Pendekatan Saintifik untuk MTS/SMP Kelas VII Semester II. *Jurnal Eksakta Pendidikan (Jep), 3*(2), 152-158.

Susilawati, E., Khausar, K., & Hera, R. (2020). Analisis Hambatan Pembelajaran Biologi Materi Jaringan Tumbuhan Dalam Pelaksanaan Kurikulum 2013 Di SMA. *Edunesia : Jurnal Ilmiah Pendidikan*, *1*(3), 1–8. https://doi.org/10.51276/edu.v1i3.48

Wiska, A., Tanjung, H. S., Rahman, A. A., & Nasryah, C. E. (2020). Pengembangan Bahan Ajar Berbasis Masalah Terintegrasi Etnomatematika Untuk Meningkatkan Kemampuan Pemecahan Masalah Siswa Kelas XI SMA. *Edunesia : Jurnal Ilmiah Pendidikan*, *1*(3), 9–20. https://doi.org/10.51276/edu.v1i3.49