

Analysis of Science Teachers' Difficulties in Developing Learning Objectives Flow in Phase D

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Abstract

In the implementation of the Merdeka Curriculum, particularly in phase D, the Learning Objectives Flow is expected to assist educational units and educators in developing steps or learning pathways based on the established Learning Outcomes. This research investigates the factors contributing to the difficulties faced by science teachers in developing Learning Objectives Flow in phase D. The study combined the collection of quantitative and qualitative data through a sequential explanatory design. Data was collected through questionnaires and interviews with 18 science teachers from junior high schools in Majene Regency, West Sulawesi Province. According to the findings, the average score of science teachers' ability to develop Learning Objectives Flow in phase D is 73.79, which falls into the moderate category based on quantitative data analysis. Based on the qualitative data analysis from interviews, the factors causing difficulties for science teachers in developing the Learning Objectives Flow in phase D include: (1) the difficulty for science teachers in understanding of Learning Outcomes for science; (2) the difficulty for science teachers in formulating Learning Objectives for science; (3) the difficulty for science teachers in systematically and logically structuring the Learning Objectives Flow for science; (4) the difficulty for science teachers in mapping the number of Lesson Hours; and (5) the difficulty for science teachers in exploring the school's potential/characteristics that support the implementation of learning. For future research, it is hoped to explore efforts that science teachers can make to overcome the difficulties of implementing the Merdeka Curriculum, especially in overcoming difficulties in preparing the Learning Objectives Flow for science in phase D.

Keywords: *Learning Objectives Flow, Learning Outcomes, Merdeka Curriculum, Science Teacher, Phase D*

Introduction

The renewal of the education curriculum is a necessity that must be undertaken to improve the quality of human resources in a nation (Zulaiha et al., 2023). The Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) has implemented a policy regarding the Merdeka Curriculum, which is applied in educational units as one of the options or additional options in the recovery of learning from 2022 to 2024 (Kamila & Rm, 2023; Yendri Farma et al., 2024). In the 2022-2023 academic year, more than 140 thousand teachers in educational institutions chose and implemented the Merdeka curriculum (Hehakaya & Pollatu, 2022). A critical aspect of implementing the Merdeka Curriculum is the development of the Learning Objectives Flow (Tanggur, 2023).

The Learning Objectives Flow serves the same function as a syllabus, acting as a reference for lesson planning (Rizal et al., 2022; Sufyadi et al., 2021). The Learning Objectives Flow is a series of Learning Objectives systematically and logically arranged within a phase as a whole and in the order of learning from the beginning to the end (Aminah & Sya'bani, 2023). The Learning Objectives Flow is a detailed and measurable depiction of the Learning Objectives. With

an explicit learning objective flow, teachers can design lessons that align with students' abilities, interests, and needs. This can increase student motivation and create a more meaningful learning experience (Ninda Akilla et al., 2023; Thana & Ramli, 2024). Additionally, the learning objective flow can assist teachers in assessing student progress and improving the learning process (Ninda Akilla et al., 2023; Nurmawita & Ain, 2023).

The Learning Objectives Flow is structured linearly, following the order of Learning Objectives carried out throughout the phase to achieve the Learning Outcomes that must be attained by the end of the phase (Kemendikbudristek, 2023). Teachers can prepare the Learning Objectives Flow in several ways, including (a) designing it themselves based on Learning Outcomes, (b) developing and modifying provided examples, or (c) using examples provided by the government (Anggraena et al., 2022). Implementing the Merdeka Curriculum gives teachers the flexibility to formulate the Learning Objectives Flow according to the Learning Objectives, the context of the educational unit, and the student's character. Thus, creating the Learning Objectives Flow results from the teacher's innovation (Riswakhyuningsih, 2022). However, based on the interview results, most science teachers at the junior high school level, especially in West Sulawesi, still prefer to use the Learning Objectives Flow examples provided by the government because it is easier than creating their own based on Learning Outcomes.

Various studies related to the implementation of the Merdeka Curriculum, particularly concerning the preparation of the Learning Objectives Flow, have been conducted at different levels of educational institutions (Mahmudah, 2023; Nurmawita & Ain, 2023; Riswakhyuningsih, 2022). For example, Mahmudah (2023) analyzed the difficulties MI teacher education students face in preparing lesson plans for the Merdeka Curriculum. The research results indicate that the most significant difficulty in preparing Merdeka Curriculum learning devices experienced by students is during the preparation of the Learning Objectives Flow. Nurmawita & Ain (2023) researched teachers' ability to prepare learning devices in the Merdeka Learning Curriculum for lower-grade elementary school classes. The research results show that teachers need help preparing learning devices such as the Learning Objectives Flow, teaching modules, and assessments. There are still some teachers who occasionally overlook the inclusion of learning focus. Another study was conducted by Riswakhyuningsih (2022) on the development of the Learning Objectives Flow for the 7th-grade science subject. The research used the Research and Development (R&D) method. The research subjects were the Learning Objectives Flow formulations for the 7th-grade science subject in junior high school. The research showed that the developed Learning Objectives Flow criteria were good and could be used in teaching.

Although there are several studies related to the Learning Objectives Flow, the literature review conducted also shows that some studies only focus on the analysis of learning components, the ability of students as prospective teachers to prepare learning devices, and the difficulties faced by elementary school teachers in implementing the Merdeka Curriculum. However, research has yet to focus on investigating the difficulties science teachers face in preparing Learning Objectives Flow in phase D (grades 7-9), especially in West Sulawesi. Therefore, this study aims to explore the factors contributing to the difficulties experienced by science teachers in creating Learning Objectives Flow in phase D.

Method

Research Design

This research combines quantitative and qualitative data collection through a sequential explanatory design (Creswell, 2012). This research involves 18 science teachers from junior high schools in Majene Regency, West Sulawesi Province. This research sample was selected

using purposive sampling, which is a sampling technique that involves determining specific criteria (Firmansyah & Dede, 2022). The criteria are as follows: (a) The research sample consists of science teachers who teach in phase D (grades 7-9); (b) The science teachers have implemented the Merdeka Curriculum in their science teaching.

Research Instruments

The instruments used in this research consist of a questionnaire and an interview guide related to science teachers' ability to develop Learning Objectives Flow in phase D. The questionnaire and interview guide were developed by the researcher and validated by three experts. The results of the instrument validation were then revised based on the recommendations and suggestions of the validators. The questionnaire used in this study consists of 18 items. These 18 statements utilize a Likert scale with four response options: strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). The interview was conducted to obtain further clarification from the science teacher regarding the difficulties in preparing the Learning Objectives Flow.

Data Analysis

Data from the questionnaires distributed to science teachers were then analyzed quantitatively using descriptive statistical analysis. At the same time, data from interviews were coded and analyzed using thematic analysis to determine the extent of the difficulties faced by science teachers in developing Learning Objectives Flow. Braun & Clarke (2006) provide a six-phase guide, a beneficial framework for conducting this thematic analysis.

Phase 1: Become familiar with the data

The first step in this analysis is to read and re-read the transcript. At this stage, it begins with noting or marking ideas for coding.

Phase 2: Generate initial codes

At this phase, data is organized systematically and meaningfully. Coding is done to reduce a large amount of data into small, meaningful pieces. The results of the interviews were analyzed using open coding adapted from several sources (Heriyanto, 2018; Maguire & Delahunt, 2017; Rohmah et al., 2024).

Phase 3: Search for themes

A *theme* is a pattern that captures something essential or intriguing in the data and research question (Maguire & Delahunt, 2017). There are no strict rules about how to create a theme (Braun & Clarke, 2006). The codes examined in this study were adjusted into a theme. By the end of this step, the codes had been organized into broader themes and appeared to have specific meanings related to the research question.

Phase 4: Review themes

A review and modification of the initial themes identified in the previous phase 3 are conducted at this stage. The data related to each theme is reconsidered for its relevance. The next step is to consider whether these themes can be applied in the overall context of the data set.

Phase 5: Define themes

This stage is the final refinement of the existing themes, and its purpose is to identify the 'essence' of each theme.

Phase 6: Writing-up

At this stage, a final analysis is conducted by reconnecting the analysis with the research questions and literature, resulting in a scientific report on the analysis.

Results

Based on the analysis of respondents' answers from the Likert scale questionnaire and the results of interviews, a general overview of science teachers' abilities in formulating Learning Objectives in phase D is presented, consisting of 5 aspects: (1) Understanding of Learning Outcomes for Science; (2) Ability to formulate Learning Objectives for Science ; (3) Ability to systematically and logically structure the Learning Objectives Flow for Science; (4) Ability to map the number of Lesson Hours; (5) Ability to explore the school's potential/characteristics that support learning implementation.

Table 1. Average Scores of Teachers in Each Aspect of Developing Learning Objectives Flow

No.	Aspect	Average
1.	Understanding of Learning Outcomes for science	77.08
2.	Ability to formulate Learning Objectives for science	75.00
3.	Ability to systematically and logically structure the Learning Objectives Flow for science	69.64
4.	Ability to map the number of lesson hours	72.92
5.	Ability to explore the school's potential/characteristics that support learning implementation	74.31
Overall Average		73.79

Understanding Of Learning Outcomes For Science

In the first aspect, which is understanding of Learning Outcomes for science, based on Table 1, the average score of science teachers is 77.08. Based on the interview results, three factors were identified that make it difficult for teachers to understand Learning Outcomes for science: the ambiguous nature of Learning Outcomes, the essential material in Learning Outcomes being still general, and the ever-changing Learning Outcomes.

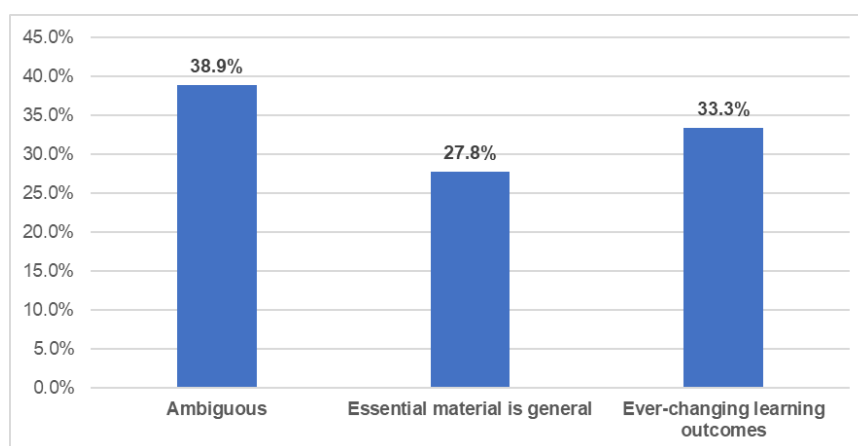


Figure 1. The Difficulties of Science Teachers in Understanding of Learning Outcomes

Figure 1 shows that 38.9% of science teachers expressed that the Learning Outcomes for science are still ambiguous. Here are some examples of teachers' opinions regarding the ambiguous Learning Outcomes for science.

I am having difficulty understanding the context and intent of some of the Learning Outcomes. There is still some ambiguity and confusion in their composition (S no. 02).

I am having trouble understanding the Learning Outcomes for science because of the ambiguous wording (S no. 13).

On the other hand, 27.8% stated that one of the factors making it difficult to understand the Learning Outcomes for science is that the essential material in the Learning Outcomes is still general. For example, one teacher argues that

I need help understanding the Learning Outcomes for science because the essential material in each learning outcome is very general, making it challenging for me to determine the Learning Outcomes for each grade level in phase D (S no. 08).

In addition, 33.3% stated that one of the factors making it difficult for teachers to understand the Learning Outcomes for science is that the Learning Outcomes for science are constantly changing. One teacher expressed that

I need help understanding the Learning Outcomes for science due to the constantly changing Learning Outcomes in a short period. In contrast, the previous Learning Outcomes have just been implemented (S no. 05).

Ability To Formulate Learning Objectives For Science

In the second aspect, the ability to formulate Learning Objectives for science, based on Table 1, shows an average score of 75.00 for science teachers. The interview results also show that teachers have trouble coming up with Learning Objectives for Science because their classes are heterogeneous, there are not any indicators to help them come up with Learning Objectives for Science, the curriculum is too broad, and they do not understand how to come up with Learning Objectives for Science.

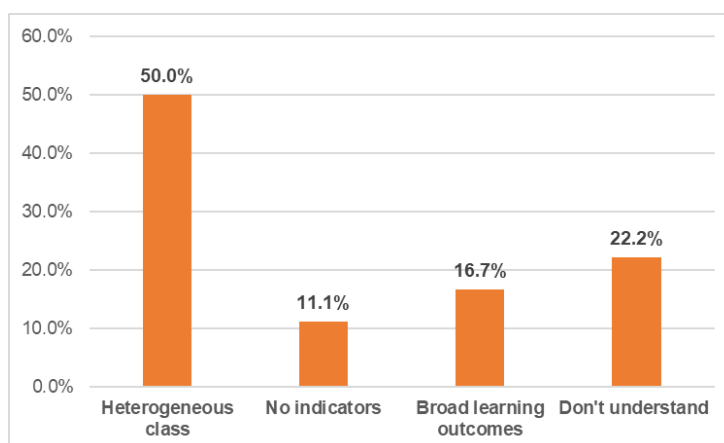


Figure 2. Science Teachers' Difficulties in Formulating Learning Objectives

According to Figure 2, the heterogeneous classroom (50.0%) is one of the factors contributing to the difficulties faced by science teachers in developing Learning Objectives. Some teachers struggle to create Learning Objectives that cater to the diverse needs of their students. Some of the science teachers' opinions include:

I am having difficulty adjusting the Learning Objectives to the diverse needs and conditions of the students (S no. 12).

I am having difficulty outlining the competencies that need to be achieved in the Learning Objectives based on students who have varying levels of knowledge (S no. 08).

I am having trouble using operational verbs when preparing Learning Objectives for a heterogeneous class (S no. 10).

Another factor causing difficulties for teachers in preparing Learning Objectives for science is the absence of indicators that can assist teachers in developing these Learning Objectives (11.1%). One teacher stated that

One of my difficulties in preparing the Learning Objectives is that the indicators in the learning process are not specified, unlike in the previous curriculum, which guided teachers to establish the indicators first before developing the Learning Objectives (S no. 04).

Another contributing factor to teachers' difficulties in preparing Learning Objectives for science is the broad Learning Outcomes (16.7%). One of the teachers' responses is

The Learning Objectives should be based on the existing Learning Outcomes. However, the existing Learning Outcomes are still too broad, making it difficult for me to create the Learning Objectives (S no. 17).

Furthermore, the factors causing teachers to experience difficulties in preparing Learning Objectives are that teachers do not yet understand how to prepare Learning Objectives (22.2%). One of the teachers' responses was:

I do not fully understand how to prepare the Learning Objectives because it is something new to me (S no. 11).

Ability To Systematically And Logically Structure The Learning Objectives Flow For Science

In the third aspect, namely the ability to systematically and logically structure the Learning Objectives Flow for science, Table 1 shows an average score of 69.64 for science teachers. Additionally, the interview results shown in Figure 3 show that teachers have trouble creating Learning Objectives Flow for science because of issues related to content (22.2%), combining physics, chemistry, and biology (38.9%), student needs (16.7%), and not fully understanding how to create Learning Objectives Flow (22.2%).

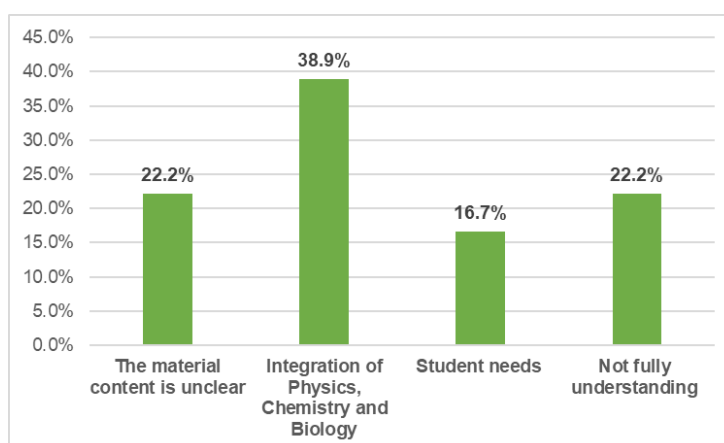


Figure 3. Science Teacher's Difficulties in Developing Learning Objectives Flow

Based on Figure 3, one of the factors that make it difficult for teachers to prepare Learning Objectives Flow is related to the content of the material. One teacher expressed the following opinion.

I find it difficult to determine the depth of the science content that should be considered in formulating the Learning Objectives Flow because the boundaries of the material are still unclear from the existing Learning Outcomes (S no. 03).

Some teachers also believe that one of the factors causing difficulties in developing the Learning Objectives Flow is the lack of integration skills in physics, chemistry, and biology in the science subject. One teacher stated that

I am having difficulty connecting content related to physics, biology, and chemistry while preparing the Learning Objectives Flow because my educational background is only in biology (S no. 05).

Another factor causing difficulties for teachers in preparing the Learning Objectives Flow is the varying needs of the students. One of the teachers conveyed that

Because of their varying prior knowledge, I am having difficulty sorting the Learning Objectives Flow based on students' needs (S no. 13).

On the other hand, another factor causing difficulties for teachers in preparing the Learning Objectives Flow is their lack of understanding regarding its preparation. Here are some responses from teachers:

I need help preparing the Learning Objectives Flow due to a lack of understanding regarding the Merdeka Curriculum, especially in formulating the Learning Objectives Flow (S no. 01, S no. 02, S no. 15, S no. 16).

Ability To Map The Number Of Lesson Hours

The fourth aspect, which is the ability to map the number of lesson hours, based on Table 1, shows that the average score of science teachers is 72.92, which falls into the moderate category. According to Figure 4, the interview results indicate that 88.9% of teachers have difficulty mapping lesson hours based on the complexity and depth of the material. In comparison, 11.1% of teachers do not know how to map the number of lesson hours.

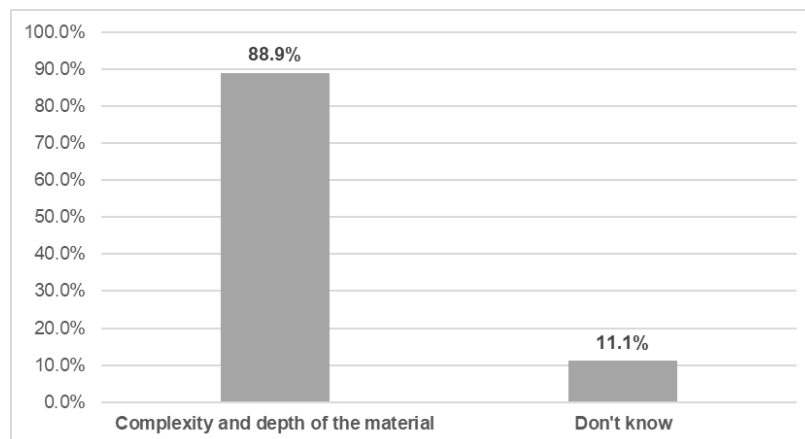


Figure 4. Science Teacher's Teachers' Difficulties in Mapping the Number of Lesson Hours

The results of the interviews indicate that several teachers are experiencing difficulties in mapping lesson hours based on the complexity and depth of the material. Here are some opinions from the science teachers.

I am having difficulty aligning the lesson hours with the depth of the material because the material outlined in the Learning Outcomes is still unclear (S no. 06).

One of the difficulties I face in mapping the lesson hours is distinguishing complex material based on students' abilities and competencies (S no. 18).

On the other hand, some teachers still need to learn how to map lesson hours. One teacher stated that.

I still need to learn how to map the lesson hours because I lack understanding and training in preparing the lesson hours (S no. 14).

Ability To Explore The School's Potential/Characteristics That Support Learning Implementation

The fifth aspect, the ability to explore the school's potential/characteristics that support learning implementation, is based on Table 1, which shows an average score of science teachers of 74.31. This result indicates that some science teachers are capable of exploring the school's potential/characteristics that support learning implementation. The results of the interviews indicate that there are several challenges faced by science teachers in exploring the school's potential to support the implementation of learning, namely broken laboratory equipment, insufficient competency in using lab kits, an unstable school internet connection, and the continued need for in-depth training related to the Merdeka Curriculum.

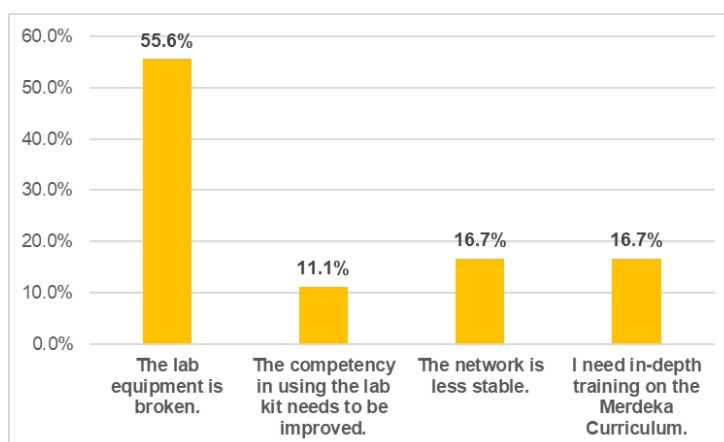


Figure 5. Factors that Hinder the Implementation of Science Learning

Figure 5 shows the results of interviews regarding the factors that can hinder the implementation of science learning. As much as 55.65% of teachers are unable to utilize laboratory facilities to support the implementation of science learning due to the laboratory equipment being in a state of disrepair. Here are some opinions from teachers as follows.

I rarely use the laboratory to support science learning activities because the lab schedule conflicts with other teachers, and the laboratory equipment is damaged (S no. 09).

I have never used the laboratory for science learning purposes because the laboratory equipment is broken and not usable (S no. 10).

The facilities at my school need to be improved, especially the laboratory, where most of the equipment is broken (S no. 18).

On the other hand, 11.1% of science teachers have complete lab facilities, but the teachers' competence in using laboratory kits still needs to be improved. One of the teachers stated that

The tools are already supported, but the skills in using some components of the kit still need to be improved (S no. 03).

In addition, 16.7% of teachers stated that an unstable network is one of the factors that hinders the implementation of the science learning process. One teacher expressed that

There is a lack of facilities that can be used to support the implementation of science learning, such as insufficient projectors and an unstable network (S no. 07).

On the other side, based on the interview results, 16.7% stated that science teachers need more in-depth training related to the Merdeka Curriculum. One of the teachers' opinions is that

We really need in-depth training related to the Merdeka Curriculum, especially concerning the Learning Outcomes and the preparation of the Learning Objectives Flow for science, so that we can support science education much better (S no. 01).

Discussion

Based on the research findings, science teachers still face difficulties in developing Learning Objectives Flow in phase D. First, teachers still struggle to understand Learning Outcomes due to the use of ambiguous Science Learning Outcomes wording, the essential material in each Learning Outcome being very general, and the changing nature of Science Learning Outcomes. This also causes teachers to have difficulty formulating Learning Objectives and continue to experience difficulties formulating Learning Objectives Flow. These findings are in line with the research conducted by Zulaiha et al. (2023), which found that teachers face difficulties when planning lessons, particularly when analyzing the Learning Outcomes to be achieved by students, as these are made per phase, then formulated into Learning Objectives and arranged into Learning Objectives Flow. Additionally, the research by Hehakaya & Pollatu (2022) also

found difficulties in the form of a lack of understanding of how to derive/translate Learning Outcomes into Learning Objectives for teachers. Meanwhile, one of the principles of developing Learning Objectives Flow is that formulating Learning Objectives Flow begins with formulating Learning Objectives from Learning Outcomes (Hadiansah, 2022).

Second, teachers need help mapping the number of lesson hours for each Learning Objective due to students' varying needs (heterogeneous). This finding is in line with the research by Umayrah & Wahyudin (2024), which states that in a heterogeneous class where students have varying levels of ability, it is difficult for teachers to meet the individual learning needs of each student. Another study by Nurcahyono & Putra (2022) also found that teachers need help understanding and accommodating student heterogeneity. According to Prafitasari (2015), it is appropriate for the diverse abilities of students to be taken into account and to be utilized and facilitated by teachers so that the heterogeneity of students' learning abilities can be minimized.

Third, teachers need help exploring the potential or characteristics of the school that support the implementation of the learning process for each academic year. Research results show that several laboratory facilities and equipment that can support the implementation of the science learning process still need to be completed or damaged. Research conducted by Rahmadani et al. (2024) also found that there still needs to be more facilities and infrastructure to support the continuity of learning. Furthermore, Zakso (2023) stated that facilities and infrastructure, such as tools and educational methods, are vital components for success in the learning process because, with the presence of tools, methods will also be efficient in learning. Therefore, the availability of laboratory equipment is essential to support the success of the science learning process.

Fourth, science teachers expect in-depth training in the Merdeka Curriculum, especially concerning Learning Outcomes and the preparation of Learning Objectives Flow for Science, to support science learning better. Research conducted by Rahmadani et al. (2024) also shows a need for more time and opportunity for teachers to attend training or workshops to help them understand and implement the Merdeka Curriculum. Another study by (Kusumawardani et al., 2022) and (Nurmawita & Ain, 2023) indicates that teachers do not encounter difficulties in preparing Learning Objectives Flow because they frequently attend training on the Merdeka Curriculum. Through training, teachers will gain additional resources for the learning process. This will support the successful implementation of the Merdeka Curriculum (Prihatien et al., 2023), especially in preparing the Learning Objectives Flow for science teachers in phase D.

Various efforts to overcome the difficulties faced by science teachers in every aspect of preparing Learning Objectives Flow in phase D are vital. Efforts that can be made, for example, are by implementing learning methods where students' diverse abilities are taken into account and can be utilized and facilitated by teachers so that heterogeneity in students' learning abilities can be minimized; one example is differentiated learning. Differentiated learning is learning that emphasizes student diversity and will be able to do well if the teacher understands student differentiation (Mulyawati et al., 2022). Apart from that, providing in-depth training to science teachers regarding the Merdeka Curriculum, especially in preparing Learning Objectives Flow in phase D, is also needed.

It is hoped that we have introduced a relatively straightforward and objective way to understand some of the factors causing difficulties for science teachers in developing the Learning Objectives Flow in phase D. Learning Objectives Flow is genuinely an important aspect that influences science instruction. Knowing the factors causing difficulties for science teachers in developing the Learning Objectives Flow in phase D has implications for the learning and accessing of scientific knowledge for school. As such, we insist that knowing this information will always be a fundamental condition for better science instruction. This research will provide

knowledge about the process of better planning for science education. Besides that, the implications of this study can help teachers detect their weaknesses and target areas that need more effort and work. Therefore, it is hoped that future researchers can carry out research related to what teachers can make efforts to overcome the difficulties of implementing the Merdeka curriculum, especially science teachers' difficulties in developing Learning Objectives Flow in phase D.

Conclusion

The research results show that the majority of science teachers still need help in every aspect of developing Learning Objectives Flow. In the first aspect, namely understanding of Learning Outcomes for science, based on research results, science teachers still experience difficulties in understanding Learning Outcomes because it is ambiguous, the essential material in Learning Outcomes for science is still general, and Learning Outcomes for science are changing. In the second aspect, the ability to formulate Learning Objectives for science, science teachers also need help in preparing Learning Objectives. The class is heterogeneous, there are no indicators to help compilation, the Learning Outcomes are broad, and the science teacher does not know how to compose the Learning Objectives. The difficulty with which science teachers comprehend Learning Outcomes and compile Learning Objectives influences their ability to compile Learning Objectives Flow because the preparation of Learning Objectives Flow must be preceded by formulating Learning Objectives from Learning Outcomes.

The third aspect, namely the ability to systematically and logically structure the Learning Objectives Flow for science, obtained based on the results of research related to the factors that teachers have difficulty in compiling Learning Objectives Flow systematically and logically, namely material content that is not clearly divided into Learning Outcomes, integration of physics, chemistry, and biology, which teachers cannot yet do because of differences in educational backgrounds, diverse needs of students, and not understanding the preparation of Learning Objectives Flow. When preparing the Learning Objectives Flow, teachers need to map the number of lesson hours for each learning objective and explore the potential/characteristics of the school that support the implementation of the science learning process for each learning objective. Based on research, in the fourth aspect, the ability to map the number of lesson hours, teachers have difficulty mapping lesson hours based on the complexity and depth of the material, and teachers need to learn how to map the number of lesson hours. In the fifth aspect, the ability to explore the school's potential/characteristics that support learning implementation, there are several obstacles for teachers in exploring the potential of schools that can support the implementation of science learning, namely damaged laboratory equipment, lack of competency in using lab kits, unstable school internet networks, and so on the need for in-depth training related to Merdeka Curriculum.

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