

## The Development of Project-Based Teaching Modules on Movement Systems and Circulatory System Materials for Senior High School

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### Abstract

*In the Merdeka Curriculum, planning for learning can be prepared optimally by making teaching modules. The purpose of this study was to determine the level of feasibility and teacher response to teaching modules for teachers on the material of the motion system and circulatory system based on projects based on the Merdeka Curriculum. This research is Research and development (R&D) with the ADDIE model, as for the stages carried out, namely: 1) Analyze, 2) Design, 3) Develop, 4) Implement, and 5) Evaluate. Data collection techniques using interviews and observations. The instruments used were interview sheets, teaching material expert validation, material expert validation, and teacher response questionnaires. The results of the feasibility of the products that have been developed in the form of teaching modules from the validation of teaching materials experts are 93.6% and the percentage of material experts is 97.5%. The results of the response test at the implementation stage carried out on a limited basis obtained results on the teaching module of 90.63%. Thus it can be concluded that the teaching module accompanied by the project-based student module that has been developed is feasible to be used by teachers to assist in the implementation of learning.*

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### Introduction

The curriculum in Indonesia continues to undergo systematic changes. The purpose of curriculum change is to improve the quality and quality of education (Santika, 2022). The impact of the Covid-19 pandemic has resulted in curriculum changes in Indonesia, namely changes from the 2013 Curriculum to the Merdeka Curriculum. The Merdeka Curriculum is an elective curriculum that began to be implemented in the academic year (FY) 2022/2023 to support learning recovery in response to online learning during the Covid-19 pandemic (Kemendikbud, 2022). Therefore, in order to restore learning and improve the quality of education during 2022-2024, the Ministry of Education and Culture issued a policy in the form of developing the Merdeka Curriculum given to educational units (Barlian & Solekah, 2022).

One of the biology subject materials in class XI contained in the Merdeka Curriculum is the organ system. In organ system material, it is translated into a motion system and a circulatory system. both of these materials often require understanding of a higher level of abstraction, which may be difficult for students who are still in the cognitive development stage (Maryana, 2021). Then this material often requires better understanding through direct practice or experimentation. The concepts contained in each material in biology learning must be truly understood by students so that there are no misconceptions in understanding the subject matter (Choden, 2020).

Lesson plan must be prepared optimally in accordance with the concept of the material, one of which is through the making of teaching modules. This Teaching Module is essential for teachers and students to assist learning activities (Ginting, 2023). Teaching modules in the Merdeka Curriculum are one of the

teaching tools that contain lesson plans (Anggraena et al., 2022). In its preparation, the teaching module must meet the criteria, namely essential, interesting, meaningful, and challenging (Kemendikbud, 2022). Therefore, one of the innovative learning models that can be applied in accordance with these criteria to achieve learning objectives is project-based or PjBL. Riyadi (2019) explains that the PjBL learning model can increase student motivation, problem solving abilities, collaboration, think critically, creatively, and provide experience in organizing a project.

Project Based Learning (PjBL) is one of the student centered learning approaches, where students are required to develop knowledge and demonstrate understanding. PjBL is one of the characteristics of the Merdeka Curriculum (Nifsa et al, 2022). This is because PjBL can support students to develop soft skills, social skills, and character according to the profile of Pancasila learners. Projects to strengthen the Pancasila learner profile can provide opportunities for students to learn in non-formal, flexible, interactive situations, and also engage directly with the surrounding environment. In biology learning, material on movement systems and circulatory systems blood can be an appropriate topic for implementing the PjBL learning model. Based on this description, the purpose of this study is to analyze the feasibility and teacher response to the development of teaching modules with Merdeka Curriculum on the material of the motion system and circulatory system based on aspects of teaching materials and material aspects.

### Methods

This study uses the ADDIE research and development model which consists of 5 stages, namely Analyze, Design, Develop, Implement, and Evaluate (Sugiyono, 2019). The instruments used were interview guidelines, validation sheets and teacher response questionnaires. The data analysis technique used was the analysis of expert validation results and teacher responses. The calculation of the questionnaire from the validator was carried out with the following formula (1) (Asyhari & Silvia, 2016), while the results of the teacher response calculation were analyzed using formula (2).

$$\text{Percentage (\%)} = \frac{\text{score obtained}}{\text{maximum score}} \times 100\% \quad (1)$$

$$P = \frac{f}{N} \times 100\% \quad (2)$$

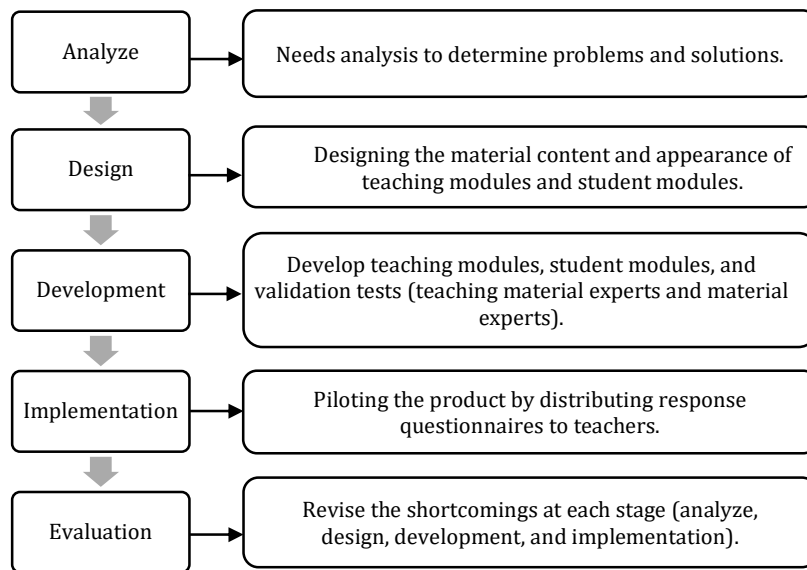
The results were then interpreted by converting the analysis results into the qualitative form, which refers to the validity category according to Akbar (2013), as presented in Table 1. Indeed, the provisions for giving decisions to convert the average score of the instrument into qualitative values, according to Widoyoko (2012), can be categorized as seen in Table 2.

**Table 1. Validity categories**

Percentage	Criteria
01,00% ≤ P ≤ 50,00%	Invalid
50,01% ≤ P ≤ 70,00%	Less valid
70,01% ≤ P ≤ 85,00%	Valid
85,01% ≤ P ≤ 100,00%	Very valid

**Table 2. Teacher Response Result Interpretation Categories**

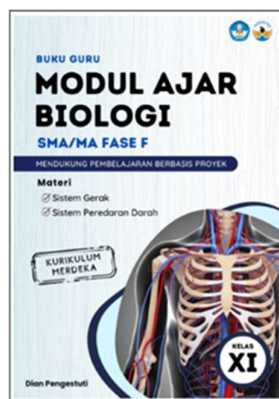
Score Range	Criteria
0% < $\bar{X}$ ≤ 20%	Not very good
20% < $\bar{X}$ ≤ 40%	Not good
40% < $\bar{X}$ ≤ 60%	Less good
60% < $\bar{X}$ ≤ 80%	Good
80% < $\bar{X}$ ≤ 100%	Very good



**Figure 1. Research procedure**

## **Results and Discussion**

The results of research and development with products developed in the form of project-based teaching modules or PjBL obtained results starting from the analysis stage. The results of the analysis conducted through interviews, obtained information that in 2022 several high schools in Magelang City and Regency have implemented the Merdeka Curriculum. In the Merdeka Curriculum, there are learning tools that change, namely lesson plans to teaching modules for teachers. Then in the planning stage, the researcher begins to design the teaching module to be developed based on the results of the analysis by determining the material and source material to be used, compiling a content structure framework, and making an initial appearance of the module. The preparation of the teaching module framework is based on the guidelines for making teaching modules by the [Ministry of Education and Culture \(2022\)](#). The appearance and design of the teaching module is made to be attractive and simple to make it easier for teachers to use.



**Figure 2. Cover of teaching modul**

In the development stage, the preparation of the teaching module is carried out which consists of three main parts, namely the initial part, the content part, and the final part. In addition, validation tests were carried out from experts to assess the quality of the feasibility of the modules developed. There are two validators, one teaching material validator and one media validator. These two validators are Biology Education lecturers at Tidar University who are experts in this field. From the results of the validation sheet that has been given by researchers to validators, it can be concluded that the teaching modules that researchers make are suitable for use with the need for revision.

The validation of teaching materials aims to determine the opinion of teaching material experts regarding the teaching modules that have been developed as a basis for improving and improving their quality. Validation is done by providing a product and validation sheet consisting of 15 questions with aspects of teaching material design, presentation, application, language, and graphics. The results of teaching material validation are presented in Table 3.

**Table 1. Teaching Module Teaching Material Validation Results**

No	Aspects	Average Score	Percentage
1	Design of teaching materials	4,25	85%
2	Retrieved	4,67	93,4%
3	Application	5,00	100%
4	Language	4,50	90%
5	Graphics	5,00	100%
<b>Average overall score</b>		<b>4,68</b>	<b>93,6%</b>
<b>Criteria</b>		<b>Very valid</b>	

Based on the validation results, the validator decided that this teaching module is "very valid", with a percentage of 93.6%. The teaching material validator also concluded that the teaching module developed could be tested in the field with revisions according to the suggestions given. There were several suggestions and inputs provided by expert validators that need to be followed up to improve the products that have been developed.

Material expert validation was carried out by providing products that have been developed and validation sheets to validators. This validation sheet consists of 10 questions covering aspects of the truth of the material and the presentation of material in the teaching module. The results of material validation were presented in Table 4.

**Table 4. Teaching Module Material Validation Results**

No	Aspects	Average Score	Percentage
1	Correctness of the material	5,00	100%
2	Presentation of material	4,75	95%
<b>Average overall score</b>		<b>4,88</b>	<b>97,5%</b>
<b>Criteria</b>		<b>Very valid</b>	

Based on the results of the material experts on the teaching modules that have been developed, the overall average percentage score is 97.5% with the criteria "very valid". Material expert validators concluded that the teaching modules developed were feasible to be tested with revisions according to suggestions.

In this study, the implementation is only limited to taking teacher responses due to considerations of the time needed to implement the Merdeka Curriculum in class XI and the completion of this research. This response test was carried out by two biology teachers. The questionnaire used consists of 15 questions with aspects of assessment including material, media, language, and motivation to utilize. Based on the results of the teacher response test for the teaching module, a percentage of 90.63% was obtained which was included in the "very good" criteria with suggestions.

**Table 5. Teacher Response Results for Teaching Modules**

No	Aspects	Average Score	Percentage
1	Materia	3,50	87,5%
2	Media	3,50	87,5%
3	Language	3,67	91,8%
4	Motivation to utilize	3,83	95,8%
<b>Average overall score</b>		<b>3,63</b>	<b>90,6%</b>
<b>Criteria</b>		<b>Very good</b>	

A project-based student module on the material of the motion system and circulatory system is produced by research development using the ADDIE model. The stages carried out in this study are Analyze, Design, Develop, Implement, and Evaluate (Sugiyono, 2019). The results of the teaching module feasibility test showed that the module is suitable for teaching material. This feasibility is proven by teaching material

experts, material experts and the overall average score from the validation results and teacher responses to development products.

The feasibility of teaching materials based on expert validation of teaching modules includes aspects of teaching material design, presentation, application, language, and graphics. Based on the results of expert validation of teaching materials, the teaching modules that have been developed are suitable for use as teaching materials with a percentage of 93.6%. This is in accordance with the statement of [Widoyoko \(2012\)](#) that teaching modules in the "feasible" category are used as biology teaching materials based on expert assessment of teaching materials.

In the aspect of the feasibility of teaching material design which includes the appropriateness of learning outcomes and learning objectives and methods, a percentage of 85% is obtained. According to teaching material experts, the teaching modules developed already have relevance. This is supported by the statement [Sudrajat \(2008\)](#) which explains that in the preparation of teaching materials it is necessary to pay attention to several principles, one of which is the principle of relevance or linkage between learning outcomes and methods. However, according to teaching material experts, learning activities have not fully led to the PjBL learning model. According to [Ngalimun \(2016\)](#) the disadvantage of the PjBL learning model is that it takes longer than other learning models so that in this teaching module the learning model in each learning activity is designed differently.

In the aspect of presentation feasibility, namely the presentation of information and material, a percentage of 93.4% was obtained. The teaching module that has been developed has a good and coherent systematic organization of material in accordance with learning indicators. [Magdalena et al. \(2020\)](#) explained that the design and development of teaching materials need to follow the rules and elements, one of which is organization. Organization in teaching materials Refers to the way learning materials or content are taught, arranged and presented so that they are easy to understand and effective for the learning process. Good organization in open materials is very important because it can help students to understand the material better and remember it better. In this teaching module, learning materials have been organized or arranged systematically to make learning effective.

In the application aspect, the percentage obtained is 100%. This is because the project-based teaching module developed facilitates teacher understanding and motivation in its application. In accordance with [Maulida \(2022\)](#) which explains that the criteria for teaching modules in the Merdeka Curriculum are interesting, meaningful, and challenging so that teachers can be motivated and foster interest in students as well.

Then in the aspect of language feasibility which includes the use of language according to the rules and the selection of vocabulary obtained a percentage of 90%. Teaching material experts assess that the teaching module is designed with good language and does not cause multiple interpretations. The selection of vocabulary in this teaching module is also easy to understand. According to [Rahmawati \(2014\)](#), vocabulary is meaningful words used to compose sentences. This teaching module is designed by selecting vocabulary that is in accordance with the cognitive development of students.

The results of the assessment of the graphical aspects which include the appearance of the design, layout, use of fonts, presentation of illustrations/images, and other supporting components for the teaching module obtained a percentage of 100% with the category "very valid". Simple design and layout motivate teachers to use it. The color combination chosen is adjusted to provide comfort in reading. The typeface used in the content of this teaching module is Times New Roman size 12 which makes it easy to read the text clearly and interestingly. The selection of illustrations, images, and appropriate supporting components also makes this teaching module look very good. This is in accordance with the opinion of [Tafonao \(2018\)](#) which states that motivation will increase if the product is more attractive.

Furthermore, the validation of material experts which includes aspects of the truth of the material and the presentation of the material. Based on the results of the validation, the average obtained is 97.5%, with the category "very valid" and suitable for use. The results of the assessment of the truth aspect of the material which includes the suitability of objectives with Learning Outcomes, suitability with biological concepts, and suitability of images with material obtained a percentage of 100%. The high acquisition of this value is because the preparation of material in the teaching module refers to the learning outcomes which are reduced to the flow of learning objectives, in accordance with the guidelines for making teaching modules for the Merdeka Curriculum ([Kemendikbud, 2022](#)). The biological concepts in the teaching module are also appropriate for high school students. Understanding concepts is important so that the learning process will be more meaningful ([Yulianti, 2017](#)). Then the images presented in the teaching module are also in accordance with the related material. This is in accordance with the statement of [Rahdiyanta \(2016\)](#) that the organization of good images and illustrations will facilitate understanding and is designed to produce teaching modules in accordance with their functions.



KEGIATAN 1	
<b>Tujuan Pembelajaran</b>	
<ul style="list-style-type: none"> <li>- Mendeskripsikan fungsi rangka pada tubuh</li> <li>- Menyebutkan tulang-tulang yang menyusun rangka tubuh manusia</li> </ul>	
<b>Persiapan Mengajar</b>	
<ul style="list-style-type: none"> <li>• Mencetak LKPD sesuai jumlah peserta didik.</li> <li>• Membaca referensi jenis-jenis tulang.</li> </ul>	
<b>Alat, Bahan, dan Sumber</b>	
Alat tulis, kertas kosong, lembar pengamatan	
<b>Pertanyaan Pematik</b>	<b>Pemahaman Bermakna</b>
<ol style="list-style-type: none"> <li>1. Bagaimana bentuk tubuh pada manusia?</li> <li>2. Mengapa kita dapat duduk dan berdiri tegak?</li> </ol>	Peserta didik akan memahami bahwa terdapat fungsi rangka sangat penting untuk memberi bentuk pada tubuh dan terdapat berbagai jenis tulang yang saling berhubungan membentuk rangka manusia.

Figure 3. Part of teaching modul

In the aspect of material presentation which includes the completeness of the material, the use of language, the currency of the material, and its usefulness, a percentage of 95% was obtained. The high acquisition of this value is because the material components are in accordance with the specified format, the references used in the material are also up to date, compliance with the rules in the use of language, systematic presentation of material, and the suitability of the material to the needs of students. According to Smith (1996) the two main things that teachers need to pay attention to when choosing teaching materials are format and content.

Thus, from the overall validation results, namely 97.5%, the teaching module is feasible and in accordance with the criteria for the Merdeka Curriculum teaching module (Maulida, 2022), the module that has been developed is feasible because it fits the criteria, namely essential, interesting, relevant, and sustainable. The teaching module is declared essential because biology is a subject that is conceptualized through learning experiences. Then the teaching module is interesting, meaningful, and challenging, this can be seen from the appearance of the teaching module and the activities of student learning activities that have been designed. The teaching module is relevant because it is in accordance with the cognitive level and experience of students. However, this teaching module cannot be called contextual, because according to the teacher's response there are learning activities that cannot be conditioned according to the school environment. Then for sustainability, the teaching module has met this criterion because it has a connection according to the learning phase, namely from Phase E to Phase F.

The results of the teacher's response to the teaching module that has been developed include aspects of material, media, language, and motivation for use obtained a percentage of 90.63% in the "very good" category. This high value is due to the aspect of teachers who are motivated to use it. This means that the teaching module developed has attractiveness. According to Plomp & Nieveen (2013), the level of attractiveness of a product can be known from the teacher's consideration regarding the material presented whether it is easy to convey to students and the product can be used properly by the teacher. Although the results of the teacher's response are very good, there are suggestions for improving the content of the teaching module, namely to choose activities that are more contextual and adapted to the conditions of the school environment. In this teaching module, the selected learning activities are not yet contextual because they are still general or not related to a specific learning context

## Conclusions

Based on the results of the development research, it is concluded that the teaching module is feasible and good to use with a percentage of teaching material expert validation of 93.6% and a percentage of material experts of 97.5%. The results of the response test at the implementation stage carried out on a limited basis obtained results on the teaching module of 90.63%. Thus, the teaching modules and project-based student modules that have been developed can be used by teachers to assist in the implementation of learning.

## References

- Akbar, S. (2013). *Instrumen Perangkat Pembelajaran*. Jakarta: Rosdakarya.
- Anggraena, Y., Felicia, N., Eprijum, D., Pratiwi, I., Utama, B., Alhapip, L., & Widiawati, D. (2022). *Buku Panduan Pembelajaran dan Asesmen Pendidikan Anak Usia Dini, Pendidikan Dasar, dan Menengah*.

- Jakarta: Pusat Kurikulum dan Pembelajaran Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Penelitian, dan Teknologi.
- Asyhari, A., & Silvia, H. (2016). Pengembangan Media Pembelajaran Berupa Buletin dalam Bentuk Buku Saku untuk Pembelajaran IPA Terpadu. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, 5(1), 1–13. <https://doi.org/10.24042/jpifalbiruni.v5i1.100>.
- Barlian, U. C., & Solekah, S. (2022). Implementasi Kurikulum Merdeka Dalam Meningkatkan Mutu Pendidikan. *Joel: Journal Of Educational And Language Research*, 1(12), 2105-2118. <https://doi.org/10.53625/joel.v1i12.3015>
- Choden, T., & Kijkuakul, S. (2020). Blending Problem Based Learning with Scientific Argumentation to Enhance Students' Understanding of Basic Genetics. *International Journal of Instruction*, 13(1), 445-462.
- Ginting, D. E. (2023). Upaya Guru Dalam Mengatasi Hambatan Merancang Modul Ajar Kurikulum Merdeka Kelas IV SDN 47/IV Kota Jambi. *Doctoral Dissertation*. Universitas Jambi. <https://repository.unja.ac.id/id/eprint/48798>
- Kemendikbud. (2022). Buku Saku Kurikulum Merdeka. Diakses pada 17 Oktober 2022 pada <https://ditpsd.kemdikbud.go.id>
- Magdalena, I., Prabandani, R. O., Rini, E. S., Fitriani, M. A., & Putri, A. A. (2020). Analisis Pengembangan Bahan Ajar. *Jurnal Pendidikan dan Ilmu Sosial*, Vol. 2, Issue 2. <https://ejournal.stitpn.ac.id/index.php/nusantara>
- Maryana, A. (2021). Pengaruh Media Edmodo Terhadap Motivasi Dan Hasil Belajar Peserta Didik Pada Materi Sistem Gerak Pada Manusia (Studi Eksperimen Di Kelas XI MIPA SMAN 4 Kota Tasikmalaya Tahun Ajaran 2021/2022) (Doctoral dissertation, Universitas Siliwangi). <http://repositori.unsil.ac.id/id/eprint/4497>
- Maulida, U. (2022). Pengembangan Modul Ajar Berbasis Kurikulum Merdeka. *Tarbawi: Jurnal pemikiran dan Pendidikan Islam*, 5(2), 130-138. <https://doi.org/10.51476/tarbawi.v5i2.392>
- Ngalimun. (2016). *Strategi dan Model Pembelajaran*. Yogyakarta: Aswaja Pressindo.
- Nisfa, N. L., Latiana, L., Pranoto, Y. K. S., & Diana, D. (2022). Pengaruh Pendekatan Pembelajaran Project Based Learning (PjBL) Terhadap Kemampuan Sosial dan Emosi Anak. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(6), 5982-5995. <https://doi.org/10.31004/obsesi.v6i6.3032>
- Plomp, & Nieveen. (2013). Educational Design Research. Netherlands Institute for Curriculum Development. *Design Research*, 153, 152-169.
- Rahdiyanta, D. (2016). *Teknik Penyusunan Modul*. Yogyakarta: Universitas Negeri Yogyakarta.
- Rahmawati, N. (2014). Pengaruh media pop-up book terhadap penguasaan kosakata anak usia 5-6 tahun di TK Putera Harapan Surabaya. *Paud Teratai*, 3(1).
- Riyadi, M., & Riyani, I. (2023). Efektivitas Model Project Based Learning Dengan Media Cisco Pakcet Tracer Terhadap Hasil Belajar Siswa pada Mata Pelajaran Administrasi Infrastruktur Jaringan Kelas XI (TKJ) SMK Muhammadiyah 2 Banjarmasin. *JUPENTI*, 2(1), 45-53.
- Rustaman, N. Y. (2004). *Asesmen Pendidikan IPA*. Bandung: Nusa Media.
- Santika, I. G. N., Suarni, N. K., & Lasmawan, I. W. (2022). Analisis Perubahan Kurikulum Ditinjau Dari Kurikulum Sebagai Suatu Ide. *Jurnal Education and Development*, 10(3), 694-700. <https://doi.org/10.37081/ed.v10i3.3690>
- Smith. (1996). *Cybernetic principles of learning and educational design*. Saint Louis: Holt Rinehart and Winston.
- Sudrajat, A. (2008). *Pengertian Pendekatan, Strategi, Metode, Teknik dan Model Pembelajaran*. Jakarta: Sinar Baru Algensindo.
- Sugiyono, D. (2013). *Metode Penelitian Pendidikan Pendekatan Kuantitatif Dan R&D*. Bandung: Alfabeta.
- Tafonao, T. (2018). Peranan Media Pembelajaran Dalam Meningkatkan Minat Belajar Mahasiswa. *Jurnal Komunikasi Pendidikan*, 2(2). <https://doi.org/10.32585/jkp.v2i2.113>
- Widoyoko, E. P. (2012). *Teknik Penyusunan Instrumen Penelitian*. Yogyakarta: Pustaka Pelajar.
- Yulianti, E. (2017). Analisis Pemahaman Konsep dan Pemecahan Masalah Biologi Berdasarkan Kemampuan Berpikir Kritis Peserta Didik Kelas XI SMA Al-Azhar 3 Bandar Lampung. *Disertasi*, Universitas Islam Negeri Raden Intan. <http://repository.radenintan.ac.id/id/eprint/2905>