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Development of Problem Based Learning (PBL) Biology Teaching Modules that Implement the Independent Curriculum on Excretion System and Reproductive System Materials

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Abstract

In the Independent Curriculum, learning planning can be optimally arranged by creating teaching modules. The purpose of this study was to determine the level of feasibility and teacher responses to teaching modules for teachers on problem-based excretory systems and reproductive systems (PBL) materials based on the Independent Curriculum. This research is a Research and development (R&D) with a 4D model, while the stages carried out are: Define, Design, Develop, and Disseminate. In this research, development was carried out to the develop stage. Data collection techniques using interviews and observation. The instruments used were interview sheets, teaching material expert validation, material expert validation, and teacher response questionnaires. The results of the feasibility of the product that has been developed are in the form of teaching modules from the validation of material experts by 92% and the proportion of teaching material experts by 97.6%. The results of the teacher response test obtained results in the open module of 93.7%. Thus it can be concluded that the teaching modules accompanied by problem-based student modules (PBL) that have been developed are suitable for use by teachers to assist the implementation of learning.

Introduction

Education is one of the ways that humans can use to survive; it is proven that humans must adapt themselves to the accelerated development of the times. To achieve this national education goal, the government has implemented improvements to improve the quality of education at various levels, including updating the curriculum learning tools and improving facilities and infrastructure. (Pamungkas, 2019). Before the pandemic, all education units in Indonesia used the 2013 curriculum. The Ministry of Education and Research and Technology made a new policy regarding using the 2013 curriculum, which looks complex when applied to online learning so that the emergency curriculum becomes a reference for education units in Indonesia. After that, during the 2021 to 2022 pandemic, the Ministry of Education and Culture made policies regarding the use of curriculum in educational units, namely the 2013 curriculum, the emergency curriculum and the independent curriculum (Maulida, 2022).

One of the class XI biology subject matters contained in the Merdeka Curriculum is organ systems. In material, organ systems are divided into excretory systems and reproductive systems. The concepts contained in each material in biology learning must be truly understood by students so that there is no misconception (Rustaman, 2004). Lesson plans must be prepared optimally in accordance with the concept of material, one of which is through the creation of teaching modules. This Teaching Module is essential for teachers and students to assist learning activities (Ginting, 2023).

The independent curriculum allows teachers to freely choose, create, use, and develop lesson plan formats. There are three core components for making lesson plans, namely, learning objectives, learning activities, and assessments. Currently, learning plans are referred to as open modules (Maulida, 2022). In its preparation, teaching modules must meet the criteria, namely essential, interesting, meaningful, and challenging activities (Kemendikbud, 2022).

The characteristics of Excretory System and Reproductive System usually contain abstract concepts where the material cannot be directly observed by the eye, because the processes occur in the human body so that students find it difficult to understand the material (Simorangkir, Napitupulu & Sinaga, 2020). Therefore, one of the innovative learning models that can be applied to achieve learning objectives is problem-based or PBL.

PBL is a learning model that exposes students to real-world problems to start learning and is an innovative learning model that can provide active learning conditions for students (Hotimah, 2020). PBL provides many benefits for students to develop higher-order thinking skills such as critical thinking, finding and using learning resources, developing cooperative work skills, and lifelong learning (Pamungkas, 2019). PBL provides many benefits for students to develop high-level thinking skills such as critical thinking, finding and using learning resources, and developing cooperative work skills. According to Arends (2008), the application of PBL in biology learning has advantages, especially related to training in problem-solving skills and critical thinking skills. This can support the Pancasila Student Profile indicator component in implementing the independent curriculum.

Based on this description, the purpose of this study was to analyze the feasibility and teacher's response to the development of the Independent Curriculum teaching module on excretory system material and the reproductive system based on material aspects and teaching material aspects.

Methods

This study uses the 4D research and development model which consists of 4 main stages, namely: Define, Design, Develop and Disseminate (Sugiyono, 2012). In this research, development was carried out to the develop stage. This model was chosen because it aims to produce a product in the form of PBL-based biology teaching modules on Excretory System and Reproductive System material. The product developed is then tested for its feasibility with a validation test by the validator and a trial data collection in the form of teacher responses. The instruments used were interview guidelines, validation sheets and teacher response questionnaires. The data analysis technique used is the analysis of expert validation results and teacher responses. The calculation of the questionnaire from the validator is carried out using the following formula (1), while the results of the teacher response calculation were analysed using the following formula (2).

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

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

Table 1. Validity categories

Percentage	Criteria
81,25 ≤ x ≤ 100%	Very valid
62,5 ≤ x <81,25%	Valid
43,75 ≤ x <62,5%	Less valid
25 ≤ x < 43,75%	Invalid

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

The results obtained were then interpreted by converting the analysis results into 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 categorised as seen in Table 2.

Results and Discussion

The results of research and development with products developed in the form of problem-based teaching modules or PBL obtained results starting from the analysis stage. The Define stage is carried out by analyzing, in the form of analyzing needs to determine problems and solutions. This analysis consists of front-end analysis, student analysis, task analysis, and concept analysis. The Design Stage is carried out by designing the content of the material and also the appearance of the open module itself. This design stage includes preparing the test, preparing the media, selecting the format, and drafting the initial design which has been revised according to the supervisor's input, which will then be carried out in the validation stage. The results of the analysis conducted through interviews, obtained information that in 2022, SMA N 1 Magelang has implemented the Independent Curriculum. In the Merdeka Curriculum there are learning tools that have changed, namely lesson plans to become teaching modules for teachers. Then at the planning stage, the researcher begins to design teaching modules that will 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 the 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 modules are made attractive and simple so that it makes it easier for teachers to use them.

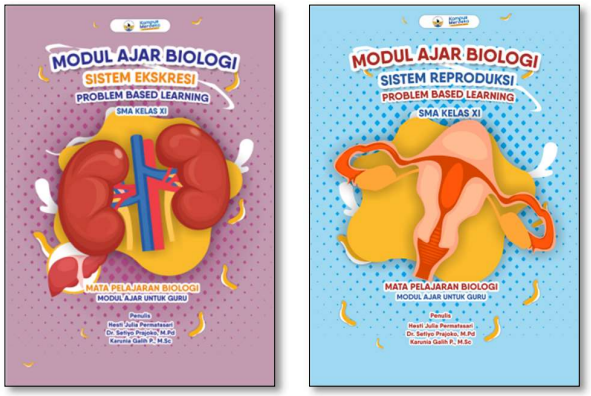

Figure 1. Cover of teaching modul

In the development stage, teaching modules are prepared, which consist of three components, namely general information, core components and attachments. In addition, a validation test was carried out by experts to assess the feasibility and quality of the developed module. From the results of the validation sheet that the researcher gave to the validator, it can be concluded that the teaching module that the researcher made is suitable for revision needs.

Material validation aims to find out the opinion of material experts regarding the teaching modules that have been developed as a basis for improving and enhancing their quality. Validation is carried out by providing products and validation sheets, which consist of 35 questions with aspects of content, language and presentation. The results of the material validation are presented in Table 3.

Table 3. Teaching Module Teaching Material Validation Results

No	Aspects	Total Score	Maximum Score	Percentage
1	Content eligibility	56	65	86%
2	Language eligibility	63	65	97%
3	Presentation eligibility	42	45	93%
	Average overall score	**53,6**	**58,3**	**92%**
	Criteria		**Very valid**	

Based on the results of the material validation, the validator decided that this teaching module was "very valid" with a percentage of 92%. The material validator also concluded that the teaching modules developed could be tested in the field with revisions according to the suggestions given. There are several

suggestions and inputs provided by expert validators that need to be followed up to improve the products that have been developed.

Expert validation of teaching materials is carried out by providing products that have been developed and validation sheets to the validator. This validation sheet consists of 40 questions, which cover aspects of format, organization, attractiveness, shape and size of letters, blank space and consistency in teaching modules. The results of validating teaching materials are presented in Table 4.

Table 4. Teaching Module Material Validation Results

No	Aspects	Total Score	Maximum Score	Percentage
1	Format	25	25	100%
2	Organization	60	60	100%
3	Attractiveness	24	25	96%
4	Shape and size of letters	43	45	95%
5	Blank space	25	25	100%
6	Consistency	19	20	95%
	Average overall score	**32,6**	**33,3**	**97.6%**
	Criteria		**Very valid**	

Based on the validation of teaching materials experts on the developed teaching modules, an average percentage score of 97.6% was obtained with the criteria of "very valid". The teaching material expert validator concluded that the teaching modules developed could be tested with revisions according to the suggestions.

In this study, the implementation was limited to taking teacher responses due to consideration of the time needed to implement the Independent Curriculum in class XI and the completion of this research. Two biology teachers carried out this response test. The questionnaire consisted of 33 questions with aspects of assessment including presentation of material, media/views, learning with modules and benefits. Based on the test results of the teacher's response to the teaching modules, a percentage of 93.7% was obtained, which was included in the "very good" category.

Table 5. Teacher Response Results for Teaching Modules

No	Aspect	Average Score	Percentage
1	Presentation of material	43	95,5%
2	Media	75.5	94,3%
3	Learning with modules	23	92%
4	Benefit	14	93%
	Average overall score	**38.8**	**93.7%**
	Criteria	**Very good**	

In research that produces products in the form of teaching modules and problem-based student modules (PBL) on excretory system and reproductive system material, this is development research using the 4D model, namely Define, Design, Develop and Disseminate (Sugiyono, 2012). In this research, development was carried out to the develop stage. The results of the feasibility test for teaching modules show that overall the module is suitable for use as teaching materials. This feasibility is proven by material experts, teaching materials experts and the overall average score of the validation results and teacher responses to product development.

The feasibility of the material based on the validation of material experts includes aspects of content, language and presentation of material in teaching modules. Based on the results of the material expert validation, the developed teaching modules are suitable for use as teaching materials with a percentage of 92%. This is in accordance with Widoyoko (2012), that teaching modules in the "appropriate" category are used as biology teaching materials based on the assessment of material experts.

The first aspect of the feasibility of the contents of the teaching modules and student modules that are developed contains several aspects adapted from BSNP (2016), including aspects of needs, updates, material coverage, material accuracy as well as being up-to-date and contextual. Based on the results of the material validation for the feasibility aspect of the content of the teaching module, a score of 56 was obtained with a percentage of 86% so that it was included in the "very valid" category. This is because the researcher presents the sub-sub-materials in a coherent and complete manner and refers to Learning Outcomes (CP). The score acquisition is also supported by the presentation of questions and LKPD which are integrated with the problem solving process and learning activities that are in accordance with the PBL

syntax. The contents of the material presented are also equipped with supporting images so as to increase student interest in learning the material. This is supported by the statements of Jannah (2020), that material accompanied by supporting images is effective in clarifying concepts and making the information conveyed more meaningful.

The linguistic feasibility aspects of the teaching modules and student modules that were developed contain several aspects adapted from BSNP (2016), including communicative aspects, suitability for students' developmental levels, coherent integrated thought patterns and the use of symbols and terms. Based on the results of material validation for the language feasibility aspect of the teaching module, a score of 63 was obtained with a percentage of 97%, so it is included in the "very valid" criteria. The acquisition of this score is supported by the presentation of the language aspects of teaching modules and student modules in language that is straightforward, communicative, dialogic and interactive. This is supported by the presentation of the example of the Reproductive System student module, at the beginning of the brief description of the research material using sentences that provoke students to think critically. The choice of vocabulary in this teaching module is also easy for students to understand. According to Rahmawati (2014), vocabulary is meaningful words used to construct sentences. In this teaching module, it is designed by selecting vocabulary according to students' cognitive development.

The feasibility aspect of presenting teaching modules and student modules that are developed contains several aspects adapted from BSNP (2016), including aspects of presentation techniques, presentation support and presentation completeness. Based on the results of material validation for the feasibility aspect of teaching module presentation, a score of 42 was obtained with a percentage of 93% so that it was included in the "very valid" category. The score obtained is supported by the presentation of teaching modules and student modules with consistency and systematic coherence of presentation, illustrations with appropriate and appropriate material, as well as the completeness of module presentation according to the Ministry of Education and Culture (2022) which includes general information components, core components and attachments. So that the presentation of information on teaching modules and student modules is described clearly and systematically. As stated by Bahtiar (2015), which states that a good module contains clear substance and is presented coherently according to indicators.

Furthermore, the results of expert validation of teaching materials include aspects of format, organization, attractiveness, shape and size of letters, empty space and consistency in teaching modules. In the first aspect, the assessment of the aspect of the format adapted according to Fajri (2019) in the teaching module obtained a score of 25 with a percentage of 100%. The high acquisition of this value is because the module components developed are in accordance with the specified format. The module format developed contains elements of teaching module components based on the Ministry of Education and Culture (2022), namely general information, core components and attachments. The two main things that teachers need to pay attention to when choosing teaching materials are format and content.

The results of the assessment of the organizational aspects of the teaching modules score 60 with a percentage of 100%. This is because the teaching modules developed have good and coherent material organizing systematics. The presentation of words and sentences in easy-to-read modules, the organization of scripts, pictures and illustrations is also appropriate. The developed module is also equipped with a concept map/chart that describes the range of material compiled based on Learning Outcomes (CP). Magdalena et al. (2020) explains that the design and development of teaching materials needs to follow the rules and elements, one of which is the organization. In this teaching module, learning materials are organized or systematically arranged to make learning effective.

In the aspect of the attractiveness of the teaching module, a score of 24 is obtained with a percentage of 96% in the "very valid" category. The score is supported by the proportional presentation of the composition and size of the layout elements, the consistent placement of layout elements based on patterns and the appearance of a good center point. The presentation of layout colors in the teaching module also clarifies the function. 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. The selection of appropriate illustrations, images, and supporting components also makes this teaching module look very good. In this aspect the validator also suggests adding realistic images according to the message to be conveyed in the module. According to Wahyuna (2016), the color and appearance of the image must contrast with the background so that it can be observed clearly.

In the aspect of the shape and size of the teaching module letters a score of 43 is obtained with a percentage of 95% so that it is included in the "very valid" category. This is because the development of this teaching module does not use too many font combinations. The selection of fonts Arial and Cambria size 12 in module development makes it easier to read writing clearly and attractively. According to Sari (2017), the letters used in the media should be varied in order to attract more students' attention to

reading. The validator also assessed that the color composition of the letters in the content/material section was appropriate. According to Tafonao (2018), motivation will increase if the product is made more attractive.

The results of the assessment of the empty space aspect of the teaching modules obtained a score of 25 with a percentage of 100% so that it is included in the "very valid" category. The high acquisition of this score is because the spacing on the cover of the module is appropriate and the spacing between columns and rows is also normal. In the module blank space containing no text or images has been used to increase the contrast. According to Arsyad (2013), "blank space is used to add contrast to text or images, this aims to provide opportunities for students or readers to rest at certain points when the eyes move across the text".

Then in the aspect of consistency the teaching module gets a score of 19 with a percentage of 95% so that it is included in the "very valid" category. The score is supported by the consistent presentation of shapes and letters from page to page as well as the distance between the title and the first line of text. Consistency in the developed modules can be seen from the researcher's confusion in presenting the substance of each material and the consistency of writing from page to page. The validator also assesses where page numbers, pictures, illustrations, tables and charts are presented consistently.

Thus, from the overall average results of the overall validation score, which is equal to 94.8%, it states that 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 module is declared essential because biology is a conceptual subject through learning experiences. Then the modules are interesting, meaningful, and challenging, this can be seen from the appearance of the modules and student learning activities that have been designed. The module is relevant because it is in accordance with the cognitive level and experience of students. Modules are declared contextual, learning activities can be conditioned according to the school environment. Then for continuity, the teaching module meets these criteria because it has a linkage according to the learning phase, namely from Phase E to Phase F.

The results of the teacher's responses to the teaching modules that have been developed include aspects of presentation of material, media, learning with modules, and benefits obtained by a percentage of 94% in the "very good" category. This high score is due to the aspect of the teacher to take advantage of. This means, the teaching modules developed have attractiveness. Presentation of material and learning activities that are presented according to PBL syntax and LKPD which are arranged to support learning activities are also integrated with presenting problems or cases of problems that are relevant to everyday life in each sub-material that can train students' critical thinking skills. So that the teacher assesses that he can easily understand the material and is very interested in using the developed module. According to Plomp and Nieveen (2013), the level of attractiveness of a product can be known from the teacher's considerations regarding the material presented whether it is easy to convey to students and the product can be used properly by the teacher. Even though the results of the teacher's response were very good, there are suggestions for improving the content of the teaching module, namely to increase the number of HOTS assessment questions and to add a little story introduction or prologue to invite students to understand a term, especially in a special context in the material. In this teaching module, the presentation of assessment questions is indeed still rare with HOTS characteristics that can explore students' abilities.

Conclusions

Based on the results of the development research, it was concluded that the teaching modules were feasible and suitable to use, with a validation percentage of teaching material experts of 92% and a percentage of material experts of 97.6%. The results of the response test at the implementation stage, which was carried out in a limited manner, obtained results in the teaching module of 93.7%. Thus, the project-based teaching modules and student modules that have been developed can be used by teachers to assist in the implementation of learning.

Reference

Akbar, S. (2013). *Instrumen Perangkat Pembelajaran*. Jakarta: Rosdakarya.

Arends, R.I. (2008). *Guide to Field Experiences and Portofolio Development to Accompany Learning to Teach*, Sixth Edition. Boston: McGraw-Hill Higer Education.

Arsyad, A. (2013*). Media Pembelajaran*. Jakarta: PT Raja Grafindo Persada.

Bahtiar, E. T. (2015). *Penulisan Bahan Ajar*. Bogor: Institut Pertanian Bogor.

BSNP. (2016). Permendiknas RI No. 22 Tahun 2006 tentang *Standar Proses Pendidikan Dasar dan Menengah*. Jakarta: BSNP.

Fajri, N. M. (2019). *Pengembangan Bahan Ajar Matematika Berbentuk Modul Pada Pokok Bahasan Perkalian untuk Siswa Kelas II A MI Azharyah Palembang* (Doctoral dissertation, UIN RADEN FATAH PALEMBANG).

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).

Hotimah, H. (2020). Penerapan Metode Pembelajaran Problem Based Learning Dalam Meningkatkan Kemampuan Bercerita Pada Siswa Sekolah Dasar. *Jurnal Edukasi*, *7*(2), 5-11.

Jannah, N., & Khairuna, K. (2022). The Influence of Learning Outcomes Using the Entrepreneurship-Based of Project Based Learning (PJBL) Model: The Application to the First Grade (X class) of Senior High School Student's in Mushroom Material. *Jurnal Pembelajaran Dan Biologi Nukleus*, 8(2), 430-441. https://doi.org/10.36987/jpbn.v8i2.2915

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

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

Pamungkas, A. K. B. (2019). *Pengembangan Modul Biologi Berbasis Problem Based Learning (PBL) Pada Materi Sistem Ekskresi untuk Keterampilan Berpikir Kritis Siswa SMA* (Disertasi Doktoral, Universitas Jember, 2019). Diakses dari https://repository.unej.ac.id/handle/123456789/92333

Plomp, & Nieveen. (2013). Educational Design Research. Netherlands Institute for Curriculum Development. *Design Research*, 153, 152-169.

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).*

Rustaman, N. Y. (2004). *Asesmen Pendidikan IPA*. Bandung: Nusa Media.

Sari, E. D. (2017). Pembuatan Flipbook Keanekaragaman Hayati sebagai Media Pembelajaran Kelas X SMA. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK)*, 6(8). https://dx.doi.org/10.26418/jppk.v6i8.21038

Simorangkir, A., Napitupulu, M. A., & Sinaga, T. (2020). Analisis kesulitan belajar siswa pada materi sistem ekskresi manusia. *Jurnal Pelita Pendidikan*, *8*(1), 1-11. http://dx.doi.org/10.24114/jpp.v8i1.11247

Sugiyono, D. (2012). *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

Wahyuna, U, S., Syamswisna., dan Yokhebed. (2016) Inventarisasi Pteridophyta Di Lahan Peti Dan Implementasinya Pada Pembuatan Flipbook Sub Materi Pencemaran Lingkungan. *JIPP. Vol 5.(5):* 1-14. https://dx.doi.org/10.26418/jppk.v3i4.5211

Widoyoko, E. P. (2012). *Teknik Penyusunan Instrumen Penelitian*. Yogyakarta: Pustaka Pelajar.