Al-Jahiz: Journal of Biology Education Research
ISSN 2722-5070 (Print) ISSN 2722-5275 (Online)
Vol. 5 No. 2 July-December 2024
Available online at:
http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

Development of a Constructivist-Oriented Teaching Module with Mind Maps for High School Biology Learning on the Excretory System

Rodiantifitri Nengsih[1]*, Nosi Qadariah[2], Rahayu Dian Eka Putri[3]
[1,2]Institut Agama Islam Negeri Kerinci
Jl. Muradi, Desa Sumur Gedang kec. Pesisir Bukit, Kota Sungai Penuh, Jambi, Indonesia
[3]Shizuoka University
836 Ohya, Suruga-ku, Shizuoka-shi, Shizuoka-ken, Japan

*Corresponding author: rodiantifn.new2024@gmail.com

Article Information

Article history:
Received: August 14, 2024
Revised: October 23, 2024
Published: November 14, 2024

Keywords:
Constructivist-based teaching, Mind map, Biology learning, Excretory system

ABSTRACT

One of the efforts to bridge students' activities in constructing their knowledge is through constructivist-oriented modules equipped with mind maps. This research aims to develop a constructivist-oriented module with mind maps for the topic of the excretory system and to assess the validity, practicality, and effectiveness of the developed learning module. This study is a development research that employs the Four-D Models, which include the stages of Definition, Design, Development, and Dissemination, though the dissemination stage was not carried out. The results indicate that the constructivist-oriented module equipped with mind maps is valid, practical, and effective. The average module validation score is 3.54, the average practical test score by teachers is 3.23, the average practical test score by students is 3.54, and the effectiveness of the module can be observed from students' motivation, activity, and learning outcomes.

INTRODUCTION

Education quality is a major issue that consistently draws attention in the educational world. Education is a process of developing quality human resources, which means having knowledge, skills, and positive attitudes (Burbules & Torres, 2013; Milner, 2010). Improvement in education quality can be achieved through enhancing the quality of the learning process, which ultimately affects the quality of educational outcomes.

One of the most practical and realistic efforts to improve the quality of both the learning process and student outcomes—indicators of educational quality—is the improvement and refinement of the learning system (Hanafiah & Suhana, 2012; Syaparuddin et al., 2020; Trisnaningsih et al., 2016). These efforts are directed towards the quality of teaching as a process, which is expected to enhance the quality of learning outcomes. Curriculum improvement is one effort that can increase the quality of education.

Al-Jahiz: Journal of Biology Education Research
ISSN 2722-5070 (Print) ISSN 2722-5275 (Online)
Vol. 5 No. 2 July-December 2024
Available online at:
http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

With the implementation of the 2022 curriculum reform, transitioning from the 2013 Curriculum (K-13) to the Merdeka Curriculum, it is hoped that this will produce graduates with abilities that meet the competency standards. Therefore, systematic, integrated, and comprehensive (Mastery Learning) development of learning for each competency is necessary. For learning aimed at achieving competencies in accordance with the graduate profiles in the KTSP, teachers need the ability to develop appropriate teaching methods and learning materials.

Minister of Education and Culture Regulation No. 16 of 2022 on the Process Standards for the Merdeka Curriculum for Early Childhood Education (PAUD), Elementary Schools (SD), Junior High Schools (SMP), Senior High Schools (SMA), and Vocational Schools (SMK). This ministerial regulation discusses Learning Planning, which involves the activity of formulating: (1) learning outcomes that serve as the learning objectives for a unit of instruction; (2) methods to achieve the learning objectives; (3) ways to assess the achievement of the learning objectives. Learning planning is carried out by educators and is compiled into a flexible, clear, and simple learning planning document. In the Merdeka Curriculum, the Learning Plan is referred to as the Teaching Module (Pramono, 2023). However, the Teaching Module that will be developed is one that is part of printed teaching materials .

From interviews conducted by the researcher with the biology teacher at State Senior High School 3 Sungai Penuh, it was found that biology teaching is still less effective. The researcher also interviewed students and discovered that students generally struggle to understand biology material, including the excretory system material. This is due to the use of conventional approaches by the teacher, who primarily employs lecture methods. Students only listen and take notes, leading to boredom and a lack of motivation to learn.

Initial observations revealed that the teaching materials available at the school are also limited and not very varied. While biology teaching requires relevant teaching media/materials that can enhance students' science process skills.

Students have been learning using the available textbooks, which contain lengthy and often convoluted material, making it difficult for students to understand the content. Additionally, students become less informed because it takes a long time to construct their knowledge, so the competency demands outlined in the curriculum, which are meant to improve their process skills, have not been fully met.

To assist students in understanding concepts in biology, particularly the excretory system material, using a learning module is believed to help students comprehend the material more easily and retain it better aik (Pramesti et al., 2019; Rahmadhania et al., n.d.; R. W. Sari & Pujiastuti,

Al-Jahiz: Journal of Biology Education Research
ISSN 2722-5070 (Print) ISSN 2722-5275 (Online)
Vol. 5 No. 2 July-December 2024
Available online at:
http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

2023). Module is a type of planned learning activity designed to assist students individually in achieving their learning goals. Thus, using modules is expected to enhance student activity and learning outcomes(Al Azka et al., 2019; Daryanto, 2013; Departemen Pendidikan Nasional, 2008; Purwanto et al., 2007; Salirawati, 2018). Demikian dengan penggunaan modul diharapkan dapat meningkatkan aktivitas dan hasil belajar siswa (Al Azka et al., 2019; Alfiriani & Hutabri, 2017; Damayanti, 2023; Indrayanti et al., 2021; Qadariah, 2022; Samsu et al., 2020).

Based on this background, one suitable teaching strategy to improve student understanding of the excretory system material is a constructivist-oriented module supplemented (Hussain, 2012; Kalpana, 2014; Kim, 2005; Suhendi & Purwarno, 2018) with mind maps.

Based on the background description, a study was conducted on "The Development of a Constructivist-Oriented Biology Learning Module Supplemented with Mind Maps for High School Excretory System Material."

RESEARCH METHODOLOGY

This research is a development *(Research and development)* study aimed at creating teaching materials, specifically a teaching module that contains content about the human excretory system for eleventh-grade senior high school students. According to Sugiyono, research and development (R&D) is a process used to develop and test products, which in the context of education can include teaching materials, modules, or teaching methods. This research aims to produce valid and practical products, as well as to evaluate the effectiveness of those products in their context of use (Sugiyono, 2022).

This learning module was developed using the 4-D model (Four-D Models), which consists of four stages (Irawan et al., 2018). According to Thiagarajan (1974, cited in Trianto, 2010: 189), these stages are Definition, Design, Development, and Dissemination.

1. Definition Stage, This stage includes syllabus analysis, interviews with teachers, and analysis of students. The results of this review are used as considerations for designing a constructivist-oriented biology teaching module on the topic of the human excretory system.
2. Design Stage, At this stage, a constructivist-oriented Biology teaching module will be developed, complete with mind maps on the topic of the excretory system for eleventh-grade senior high school students. The student module will be structured based on the applicable biology curriculum and will include mind maps and practice tasks related to the discussed material, which will later be used for evaluation to measure the effectiveness of the book being

developed. The distinctive feature of the module to be created is the presentation of tasks based on the constructivist learning model.

3. Development Stage. The development stage aims to produce a valid, practical, and effective constructivist-oriented Biology teaching module, complete with mind maps on the topic of the excretory system for eleventh-grade senior high school students. The validity test will use a validation sheet instrument, the practicality test will employ teacher and student response sheet instruments, while the effectiveness test will utilize a question sheet instrument.

Due to time and budget constraints, this research was conducted only up to the Development stage. The subjects for testing were used to evaluate the practicality and effectiveness of the module.

The trial was conducted using a questionnaire with students from State Senior High School 3 Sungai Penuh, class XI IPA1, totaling 44 students. There were 12 male students and 32 female students. The data type is primary data, obtained directly from lecturers, teachers, and students through questionnaires testing the validity, practicality, and effectiveness of the module.

RESULT AND DISCUSSION

Phase 1: Definition

This stage involves several activities, namely curriculum analysis, student analysis, and concept analysis. In the curriculum analysis, SMA Negeri 3 Sungai Penuh has implemented the Merdeka Curriculum, but only in Phase E or Class X. Meanwhile, Classes XI and XII have not adopted the Merdeka Curriculum and are still using the 2013 Curriculum. Teachers strongly agree to be introduced to teaching modules that align with the Merdeka Curriculum. After the curriculum analysis, the next step is concept analysis. In the material on the excretory system, several learning objectives were identified: (1) Students can explain the introduction to excretion; (2) Students can identify human excretory organs; (3) Students can conduct a simple practical experiment on the mechanism of urine formation; (4) Students can analyze disorders of the excretory system.(Refmianti et al., 2023)

In this research, the subjects are 11th-grade high school students aged 16-17. According to Piaget (Sanjaya, 2008:262), students at this age are at the formal operational stage (Woolfolk, 2016). At this stage, students are capable of abstract thinking and understanding the underlying meanings of concepts, relationships, and theories (O'Donnell et al., 2024). The concept analysis aims to

determine the content and subject matter needed for the development of this module (Al Azka et al., 2019).

Constructivist-oriented teaching modules equipped with mind maps in biology learning are very suitable for implementation in the Merdeka Curriculum, as it provides freedom for teachers and students to adjust teaching methods according to their needs. The constructivist approach supports this by facilitating student-centered learning, where they actively build knowledge through collaboration and reflection. Thus, both complement each other to create a more dynamic and meaningful learning environment (Rahmayumita & Hidayati, 2023).

Phase 2: Design

At this stage, a framework and detailed program for the developed module have been prepared (Irawan et al., 2018). The front cover contains the identity/title of the module, the subject identity, and the materials to be developed (Daryanto, 2013). The front cover is designed to be as attractive as possible with a dominant green color. It features an image of the excretory organs, which represents the material to be discussed in the learning module.

The module usage instructions include how to use the module for both teachers and students. The instructions for teachers outline their role as facilitators in learning. The instructions for students explain how they should use the module and fill out student worksheets and evaluation sheets to achieve competencies (Qadariah et al., 2019; Salirawati, 2018).

The table of contents provides pages that guide students or teachers to the desired materials or sheets (Yahya, 2010). The introductory sheet contains an introduction to the excretory system before students delve into the main topics presented in the module (Seeley et al., 2008). Next is the main content about the excretory system. The characteristic feature of a constructivist orientation is found in the material description that includes constructivist questions at the beginning of the content, as well as images of the excretory system, complemented by a mind map to support the discussion of the material.

It includes a display of learning objectives (Purwanto et al., 2007). The learning objectives aim to inform students about the competencies to be achieved in the learning process. The student activity sheet contains lessons that students must master. The material arrangement aligns with the instructional objectives to be achieved. The material descriptions use simple language to ensure they are easily understood by students (Parmin & Peniati, 2012). The material is also equipped with mind maps and images related to the excretory system to enhance student understanding.

Al-Jahiz: Journal of Biology Education Research
ISSN 2722-5070 (Print) ISSN 2722-5275 (Online)
Vol. 5 No. 2 July-December 2024
Available online at:
http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

The student worksheet contains exercises in the form of essay questions and mind mapping tasks that are aligned with the material descriptions on the student activity sheet (Permadi, 2016). The essay questions are formulated using a constructivist approach, while the mind mapping tasks consist of blank mind maps to be filled in by students.

The evaluation sheet is designed to assess overall mastery of the material in multiple-choice format. This sheet includes answers to the questions on the worksheet and evaluation. It serves as a reference for students to provide feedback, allowing them to assess their own work. The conclusion summarizes the main ideas of the excretory system learning content.

The bibliography contains a list of information sources for the material. This bibliography can be used by students to trace information and deepen their understanding and development of learning materials in accordance with the established learning objectives.

Phase 3: Development

1. Validity of the module

The validation data conducted by 5 validators indicates that the constructivist-oriented learning module, which includes a mind map for 11th-grade high school students on the topic of the excretory system, is highly valid, with an average score of 3.54. The validation results can be seen in Table 1.

Table 1. Results of the Validation of the Constructivist-Oriented Teaching Module with Mind Map for 11th Grade Science High School Students on the Topic of the Excretory System.

No	Assessment Standards	Validation Score	Category
1	Didactic Requirements	3,5	Highly Valid
2	Construct Requirements	3,6	Highly Valid
3	Technical Requirements	3,5	Highly Valid
	Jumlah	3,5	Highly Valid

Based on Table 1, the average validation score is 3.5 in the Highly Valid category. This means that the constructivist-oriented teaching module, which includes a mind map for biology lessons for 11th-grade high school students on the topic of the excretory system, can be used. According to Trianto (Trianto, 2017), validity means that the assessment provides accurate information about the developed teaching materials. The teaching materials in the form of a module are considered valid after meeting three requirements: didactic, construction, and technical. In line with Trianto's opinion, Hapsari states (Hapsari & Wulandari, 2020), that teaching materials can be considered valid if they can be used in the learning process according to the curriculum.

Al-Jahiz: Journal of Biology Education Research
ISSN 2722-5070 (Print) ISSN 2722-5275 (Online)
Vol. 5 No. 2 July-December 2024
Available online at:
http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

The content of the constructivist-oriented teaching module, which includes a mind map for biology lessons for 11th-grade high school students on the topic of the excretory system, aligns with the current Merdeka Curriculum. The Merdeka Curriculum provides freedom for teachers and students to adjust their teaching methods according to their needs. The constructivist approach supports this by facilitating student-centered learning, where students actively build knowledge through collaboration and reflection (Pramono, 2023). Referring to the product categorization criteria by Arikunto (Arikunto, 2018), the developed teaching module can be categorized as appropriate in terms of content. The aspects assessed for content suitability are adapted from the criteria that must be met in teaching modules as determined by the Ministry of Education and Culture (Kementerian Pendidikan, Kebudayaan, Riset, 2020).

2. Practicality of the Module

The results of the teacher survey analysis indicate that the constructivist-oriented teaching module, which includes a mind map on the topic of the excretory system, is categorized as practical for use in the learning process, with an average practicality score of 3.23, placing it in the practical category. The details of the practicality test results can be seen in Table 2.

Table 2. Results of the Practicality Test of the Constructivist-Oriented Teaching Module with Mind Map for Biology Lessons for 11th Grade High School Students on the Topic of the Excretory System

No	Respondent	Assessed Aspect	Score	Category
1	Teacher Response	Usage	3,2	Practical
		Presentation	3,5	Highly Practical
		Time	3	Practical
	Total		3,23	Practical
2	Student Response	Usage	3,67	Highly Practical
		Presentation	3,63	Highly Practical
		Time	3.32	Practical
	Total		3,54	Highly Practical
	Average Total		**3,38**	**Practical**

Based on Table 2, it can be seen that out of the 3 (three) practicality indicators, c is suitable for use in learning activities in the practical category. According to (Wahyu et al., 2019), a teaching module is considered practical if it is easy to use, makes learning time efficient, and provides benefits in learning. The developed teaching module can also assist and facilitate teachers in accurately explaining biological concepts to students, particularly on the topic of the excretory system. If both teachers and students

Al-Jahiz: Journal of Biology Education Research
ISSN 2722-5070 (Print) ISSN 2722-5275 (Online)
Vol. 5 No. 2 July-December 2024
Available online at:
http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

respond positively to a teaching material, it can be used in the learning process (Angela et al., 2013; Trianto, 2017).

Mind mapping adds visual elements to the teaching module; the appealing colors in the mind map, along with the images included in the material, enhance engagement and reduce student boredom while studying (Angela, 2019; Fitri & Hendri, 2013). The constructivist approach in the essay-type assignments facilitates students' understanding of the questions. The questions begin by constructing students' knowledge through storytelling, which helps them comprehend and answer the questions. Constructivism holds that students come to class with pre-existing knowledge, ideas, or beliefs. Students can then revise, add to, or synthesize new knowledge through the learning process (Saputra et al., 2016).

3. effectiveness of the module

The effectiveness of the constructivist-oriented teaching module, which includes a mind map for biology lessons for 11th-grade high school students on the topic of the excretory system, can be seen in the activities, motivation, and learning outcomes of the 11th-grade science students.

a. Learning Activities

The results of observing the learning activities of students using the constructivist-oriented teaching module, which includes a mind map for biology lessons for 11th-grade high school students on the topic of the excretory system, can be seen in Table 3 below:

Table 3. Results of Observing Learning Activities Using the Constructivist-Oriented Teaching Module with Mind Map in Biology Lessons for 11th Grade High School Students on the Topic of the Excretory System

No	Observed Aspect	Meeting I	Meeting II	Meeting III	Average	Category
1	Paying attention to the teacher's explanation	97,74	95,44	100	97,73	Very Active
2	Using the module according to the teacher's instructions	88,03	93,16	88,98	89,9875	Very Active
3	Studying the material and answering questions	97,73	100	100	99,24	Very Active
4	Discussing/Q&A	80	72,73	80,55	77,76	Active
5	Completing worksheets and evaluations	100	100	100	100	Very Active

Based on Table 3, it can be seen that the 5 (five) observed aspects indicate that student activities in learning using the constructivist-oriented teaching module, which includes a mind map for biology

Al-Jahiz: Journal of Biology Education Research
ISSN 2722-5070 (Print) ISSN 2722-5275 (Online)
Vol. 5 No. 2 July-December 2024
Available online at:
http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

lessons for 11th-grade high school students on the topic of the excretory system, fall into the very active category. Student engagement can be seen from their participation and involvement in responding to the teaching module (Oktarina et al., 2018). The constructivist approach helps students construct their own knowledge, which is then guided by the teacher to create new meaning (Trianto, 2017). One of the most important indicators of student activity is the presence of discussions or Q&A between students and between students and teachers (Syaparuddin et al., 2020).

b. Student Learning Motivation

The results of the analysis of student learning motivation using the constructivist-oriented teaching module, which includes a mind map for biology lessons for 11th-grade high school students on the topic of the excretory system, can be seen in Table 4.

Table 4. Results of the Analysis of Student Learning Motivation.

No	Indicator	Percentage (%)	Motivation Criteria
1	Motivation	91,05	Very High
2	Relevance	91,48	Very High
3	Expectations	91,89	Very High
4	Satisfaction	96,48	Very High
	Average	**92,89**	**Very High**

The table above illustrates the results of the analysis of student learning motivation using the constructivist-oriented teaching module, which includes a mind map. The high percentages across all motivation indicators motivation, relevance, expectations, and satisfaction demonstrate the effectiveness of the constructivist approach in enhancing student engagement and participation.

The constructivist approach emphasizes that students actively build their own knowledge through meaningful learning experiences (Saputro & Pakpahan, 2021).The use of relevant and interactive modules provides students with the opportunity to connect the material to real-life situations, thereby increasing the relevance of learning (91.48%) and their expectations for learning outcomes (91.89%). Additionally, this approach encourages discussions and collaboration among students, contributing to the very high level of learning satisfaction (96.48%).

Thus, the constructivist approach not only helps students understand the material better but also enhances their motivation and satisfaction in the learning process, as reflected in the

data presented in the table. This aligns with findings in educational literature indicating that active and relevant learning experiences can significantly boost student motivation to learn (R. T. Sari, 2018).

c. Learning outcomes

The learning outcomes obtained from daily tests after students completed the lessons on the excretory system using the constructivist-oriented teaching module, which includes a mind map for biology lessons, showed that they met the Minimum Competency Criteria (KKM) and the Learning Objective Achievement Criteria (KKTP) with a score of 80.5. Meanwhile, the KKM established at the school is 78. Out of 42 students in Class XI IPA 1, 100% met the KKM. The use of the constructivist-oriented teaching module can significantly enhance student learning outcomes (R. T. Sari, 2018), as students do not just receive information but also interact with and construct their own knowledge in a more meaningful context. Constructivist-oriented teaching modules often employ various methods and media, such as mind mapping, group discussions, and collaborative projects. This variety makes learning more engaging and accommodates different learning styles, thus improving engagement and learning outcomes (Saputra et al., 2016).

CONCLUSIONS

It can be concluded that the development resulted in a constructivist-oriented teaching module, which includes a mind map for biology lessons for 11th-grade high school students on the topic of the excretory system. Based on validity testing, practicality testing, and effectiveness testing, the module is deemed valid, practical, and effective.

REFERENCE

Al Azka, H. H., Setyawati, R. D., & Albab, I. U. (2019). Pengembangan Modul Pembelajaran. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, *1*(5), 224–236.

Alfiriani, A., & Hutabri, E. (2017). Kepraktisan dan keefektifan modul pembelajaran bilingual berbasis komputer. *Jurnal Kependidikan*, *1*(1), 12–23.

Angela, L. (2019). Pengembangan Modul Fisiologi Tumbuhan Berorientasi Konstruktivisme Dilengkapi Peta Pikiran. *Tarbawi: Jurnal Ilmu Pendidikan*, *15*(1), 107–117.

Angela, L., Razak, A., & Anhar, A. (2013). PENGEMBANGAN MODUL BERORIENTASI KONSTRUKTIVISME DILENGKAPI PETA PIKIRAN PADA MATA KULIAH FISIOLOGI TUMBUHAN DI STAIN KERINCI. *Kolaboratif*, *1*(2).

Arikunto, S. (2018). *Dasar-Dasar Evaluasi Pendidikan Edisi 3* (3rd ed.). Rineka Cipta.

Burbules, N. C., & Torres, C. A. (2013). Globalization and education: An introduction. In *Globalization and education* (pp. 1–26). Routledge.

Damayanti, I. (2023). *PENGEMBANGAN MEDIA BUSY BOOK SEBAGAI MEDIA PEMBELAJARAN PENDIDIKAN KARAKTER PEDULI LINGKUNGAN PADA*

ANAK USIA 5-6 TAHUN DI KECAMATAN MUARA BULIAN. Universitas Jambi.

Daryanto. (2013). *Menyusun Modul Bahan Ajar Untuk Persiapan Guru Dalam Mengajar*. Gava Media.

Departemen Pendidikan Nasional. (2008). *Penulisan Modul*. Direktur Tenaga Kependidikan.

Fitri, R. H., & Hendri, W. (2013). PENGEMBANGAN MODUL PEMBELAJARAN BIOLOGI BERNUANSA PENDEKATAN KONSTRUKTIVISME PADA MATERI SISTEM GERAK UNTUK SISWA KELAS VIII SMPN 12 PADANG. *JURNAL FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN*, *2*(4).

Hanafiah, & Suhana, C. (2012). *Konsep Strategi Pembelajaran*. Refika Aditama.

Hapsari, T. P. R. N., & Wulandari, A. (2020). Analisis kelayakan buku ajar milenial berbasis augmented reality (AR) sebagai media pembelajaran teks prosedur di magelang. *Diglosia: Jurnal Kajian Bahasa, Sastra, Dan Pengajarannya*, *3*(4), 351–364.

Hussain, I. (2012). Use Of Contructivist Approach In Higher Education: An Instructors Observervation. *Creative Education*, *3*(3), 179–184.

Indrayanti, I., Ngabekti, S., & Astuti, B. (2021). Development Of Guided Inquiry Based Learning Modules To Improve Environmental Attitude And Hight Order Thinking Skills. *Journal of Innovative Science Education*, *10*(1), 65–69.

Irawan, A. G., nyoman Padmadewi, N., & Artini, L. P. (2018). Instructional materials development through 4D model. *SHS Web of Conferences*, *42*, 86.

Kalpana, T. (2014). Contructivist Perspective on Teaching and learning: A Conceptual Framework. *International Research Journal of Social Sciences*, *3*(1), 27–29.

Kementerian Pendidikan, Kebudayaan, Riset, dan T. R. I. (2020). *Komponen Modul Ajar*. https://pusatinformasi.kolaborasi.kemdikbud.go.id/hc/id/articles/5010555956377-Komponen-Modul-Ajar

Kim, J. (2005). The Effects of a Contructivist Teaching Approach on Student Academic Achievment, Self-concept, and Learning Strategies. *Asia Pacific Education Review*, *6*(1), 7–19.

Milner, H. R. (2010). Culture, curriculum, and identity in education. In *Culture, curriculum, and identity in education* (pp. 1–11). Springer.

O'Donnell, A. M., Dobozy, E., Nagel, M. C., Bartlett, B., Smala, S., Wormald, C., & Yates, G. (2024). *Educational psychology*. John Wiley & Sons.

Oktarina, K., Lufri, L., & Chatri, M. (2018). Validity of Learning Module Natural Sciences Oriented Constructivism with the Contain of Character Education for Students of Class VIII at Yunior Hight School. *IOP Conference Series: Materials Science and Engineering*, *335*(1), 12091.

Pramesti, B. N., Sajidan, Dwiastuti, S., & Setyaningsih, E. (2019). The Feasibility of Biology Module Based on Stim-HOTS Models. *Jurnal Pendidikan Biologi Indonesia*, *5*(1), 101–108. https://doi.org/https://doi.org/10.22219/jpbi.v5i1.7385

Pramono, G. (2023). *Konstruktivisme dalam Kurikulum Merdeka Belajar (KMB)*. Direktorat Guru

Pendidikan Dasar. https://gurudikdas.kemdikbud.go.id/news/konstruktivisme-dalam-kurikulum-merdeka-belajar-%28kmb%29

Purwanto, A.Rahadi, & Lasmono, S. (2007). *Pengembangan Modul*. Depdiknas.

Qadariah, N. (2022). Pengembangan Modul Evolusi Berbasis Problem Based Learning (PBL) Untuk Meningkatkan Hasil Belajar Kognitif Mahasiswa di Jurusan Biologi Institut Agama Islam Negeri Kerinci. *Symbiotic: Journal of Biological Education and Science*, *3*(1), 39–49.

Rahmadhania, F., Armenb, R. D., Fadilahb, M., & Putrib, D. H. (n.d.). *The Development of Biology Module Based on Emotional Spiritual Quotient in Evolution Topic for Senior High School*.

Rahmayumita, R., & Hidayati, N. (2023). Kurikulum Merdeka: Tantangan dan implementasinya pada pembelajaran Biologi. *Biology and Education Journal*, *3*(1), 1–9.

Refmianti, W., Syamsurizal, S., Arsih, F., & Rahmatika, H. (2023). Validasi Pengembangan Modul Ajar Pola-pola Hereditas Berbasis Problem Based Learning. *Journal On Teacher EducatioN*, *4*(4), 19–27.

Salirawati, D. (2018). *Teknik Penyusunan Modul Pembelajaran*.

Samsu, N., Mustika, D., Nafaida, R., & Manurung, N. (2020). Analisis kelayakan dan kepraktisan modul praktikum berbasis literasi sains untuk pembelajaran IPA. *JIPI (Jurnal IPA & Pembelajaran IPA)*, *4*(1), 29–40.

Saputra, I. D., Anggraeni, S., & Supriatno, B. (2016). Implementasi Pendekatan Konstruktivisme pada Pembelajaran Biologi dalam Meningkatkan Kemampuan Literasi Kuantitatif dan Sikap Ilmiah Siswa SMA pada Materi Pencemaran Lingkungan. *Proceeding Biology Education Conference: Biology, Science, Enviromental, and Learning*, *13*(1), 249–254.

Saputro, M. N. A., & Pakpahan, P. L. (2021). Mengukur keefektifan teori konstruktivisme dalam pembelajaran. *Journal of Education and Instruction (JOEAI)*, *4*(1), 24–39.

Sari, R. T. (2018). Efektifitas modul pembelajaran biologi melalui pendekatan konstruktivisme. *PROSIDING SEMINAR NASIONAL LINGKUNGAN LAHAN BASAH*, *3*(2).

Sari, R. W., & Pujiastuti, P. (2023). Social studies learning modules to improve concept understanding and attitude of the environmental care. *Journal of Education and Learning (EduLearn)*, *17*(1), 127–135.

Sugiyono. (2022). *METODE PENELITIAN DAN PENGEMBANGAN* (3rd ed.). Alfabeta Bandung.

Suhendi, A., & Purwarno. (2018). Contructivist learning theory: The contribution to foreign language learning and teaching. *KnE Social Sciences*, *3*(4), 87–95. https://doi.org/http://doi.org/10.18502/kss.v3i4.1921

Syaparuddin, S., Meldianus, M., & Elihami, E. (2020). Strategi pembelajaran aktif dalam meningkatkan motivasi belajar pkn peserta didik. *Mahaguru: Jurnal Pendidikan Guru Sekolah Dasar*, *1*(1), 30–41.

Trianto. (2017). *Mendesain Model Pembelajaran Inovatif, Progresif, Dan Konteksual* (3rd ed.).

PrenadaMediaGroup.

Trisnaningsih, S., Suyanto, S., & Rahayu, T. (2016). Pengembangan learning management system quipper school pada pembelajaran materi sistem pertahanan tubuh untuk meningkatkan motivasi dan hasil belajar siswa kelas XI di SMA Negeri 3 Yogyakarta. *Jurnal Edukasi Biologi*, *5*(6).

Wahyu, P. A., Putra, A., Hamdi, H., & Mufit, F. (2019). Validitas dan praktikalitas LKPD berbasis model simas eric pada materi pengukuran dan vektor untuk kelas X SMA/MA. *Pillar of Physics Education*, *12*(3).

Woolfolk, A. (2016). *Educational psychology*. Pearson.