

The Development of Constructivism-Based Biology Learning Modules Equipped With Mind Maps on the Material of Excretion and Coordination System for the 11TH Grade Semester 2

R Anggraini^{1*} A Razak¹ D H Putri²

¹ Biology Department Postgraduate, Faculty of Mathematics and Sciences, Universitas Negeri Padang, Padang, Indonesia

² Biology Department Postgraduate, Faculty of Mathematics and Sciences, Universitas Negeri Padang, Padang, Indonesia

³Biology Department Postgraduate, Faculty of Mathematics and Sciences, Universitas Negeri Padang, Padang, Indonesia

*Corresponding author. Email: riinanggraini@gmail.com

ABSTRACT

Referring to the data in the preparation stage, students find it difficult to understand the concept of subject matter. The concept can be understood by constructing initial knowledge with newly acquired knowledge. The stages of constructing the concept are in the integrated constructivism approach in the module. The module can be used by students as a companion teaching material independently and help construct their knowledge. Mind maps are used to make it easier for students to recall the concepts of material that they have learned. This research basically aims to produce a valid, practical and effective Biology learning module. This type of research is included in the type of research development using the Plomp model, which consists of the stages of preparation, prototype development and assessment stage. The instruments used were interview guide sheets, validation assessments, and practicality assessments. Observation sheets on affective, psychomotor and multiple choice questions for cognitive aspects were used to assess the module effectiveness. The results of the validation by the experts on the module showed a valid category (75.8%), which means that the module met the criteria in terms of construct, content, graphics, and language. The results of practicality in this case by the teacher and students show practical categories (75%) and very practical (89.01%), because of the ease of use, the benefits obtained, and the efficiency of the time in their use. Seen from the cognitive, affective and psychomotor aspects, the module effectiveness test results show that the module is effective in helping the achievement of the three domains of competence. Thus, it can be concluded that the Biology learning module developed has been valid, practical, and effective.

Keywords: *constructivism, mind map, module*

1. INTRODUCTION

Education taking place in the classroom is packaged in the form of learning. Learning has been interpreted as a process of interaction between students and students, between students and educators and learning resources in a learning environment^[3]. During the learning process, students are required to actively participate in the learning process. This active participation can only occur if students have prior knowledge.

Biology is one of the subjects taught in the 2013 curriculum. According to the constructivism perspective, Biology learning contains four core activities; relating to

prior knowledge, real experiences, social interactions and sensitivities to the environment^[7].

Biology Learning consists of various topics that have certain characteristics. The excretion system and coordination system are topics discussed in Biology learning. The topic of the excretion system and coordination system has a concept structure that connects concept abstraction, the linkages between an organ and other organs so that the necessary facilities and learning models are in accordance with the character of the concept^[9].

Based on the results of data collection conducted by the author in October 2016 at SMA Negeri 3 Padang on Biology study teachers and students of class XII MIPA using questionnaires, there are difficulties experienced by

students in understanding the subject if the teacher does not explain the topic of the lesson and relate it to contextual issues.

Learning Biology should encourage students to be able to construct their knowledge independently through learning experiences^[7]. The results of the questionnaire answers from students also showed that 80% of students still needed their teacher's guidance in constructing their prior knowledge. This is because each student has different prior knowledge or no prior knowledge at all, so it will be difficult to construct the prior knowledge he has with the newly acquired knowledge. As a result, students will find it difficult to actively participate in the learning process.

To overcome these problems, teaching materials are needed in the form of learning modules with the aim that these modules can be used by students as companion teaching materials that can focus individual student abilities and can be studied independently with limited assistance from the teacher. Modules as teaching materials are arranged systematically in a language that is easily understood by students and can be studied independently with limited assistance from teachers or educators^[5]. The module as printed teaching material is designed to be studied independently by learning participants. This certainly has advantages in accordance with the principle of writing a module that has feedback from the module so students can evaluate themselves^[2]. Modules considered as a delivery system in the teaching and learning process will be more optimal if it is oriented towards a particular approach. In this case, one of the approaches used is the constructivism approach.

Constructivism learning is actually a way of learning that develops students' thinking to learn more meaningfully by working alone, trying to find it for themselves and constructing their own new knowledge and skills^[8]. With the existence of a constructivism approach, the development of knowledge for students could be done by students themselves through research activities or direct observation. This way, the students can channel their new ideas in accordance with experience by finding facts that are consistent with the study of the theory being studied. The students will later be required to link their prior knowledge with the new knowledge and experiences that have already existed within themselves.

Meanwhile, the modules produced will contain the characteristics of the constructivism approach, namely the stages of orientation, elicitation, idea restructuring, use of ideas and review. In this developed module, one of the applications of using ideas is in the form of mind maps. Mind Map is a technique of recording in other visual forms in terms of how to connect and integrate various things starting with the main topic^[1]. Mind Map is very useful for understanding the material and aims to make the subject matter patterned visually and

graphically which in turn can help record, strengthen, and recall information and concepts of the material that have been learned².

2. MATERIALS AND METHODS

A development study using the Plomp model has been applied in this research, which consists of the stages of preparation, prototype development, and assessment stages. The product trial was carried out in a limited way at SMAN 3 Padang with the subject of testing being carried out in one class of the XI MIPA students of SMAN 3 Padang. The instruments used were interview guide, validation assessment, and practicality assessment sheets. To assess the effectiveness of the module, observation sheets are used on the aspects of affective, psychomotor and multiple-choice questions for the cognitive aspect.

3. RESULT AND DISCUSSION

Data The validation results have definitely shown that module validity has been fulfilled which could be seen from the average overall validation value of 75.8 with a valid category. The aspects of validity assessed by the experts consisted of four aspects; the aspects of construct, content eligibility, graphics, and language. This validity shows that the module developed has met the requirements for the preparation of teaching materials and is in accordance with the demands of KI, KD, and learning indicators in the applicable curriculum.

After validation, the module practicality test is then conducted, starting with the one-on-one evaluation which was carried out by direct interviews with three students with different levels of ability from one another. The practicality test results in this one-on-one evaluation indicate that the module developed as with a category of very practical in the aspects of ease of use, benefits obtained, and time efficiency.

After the revision has been completed to the module in accordance with the results of the one-on-one evaluation, the next step is to conduct a practicality test on small groups. Small group evaluations were conducted on nine students with different levels of ability. Overall, they scored very practical categories from the three variables assessed. The sub variable value of the ease of use gets a score in the category of very practical, which means students can use the learning module easily because the learning module developed is accompanied by clear usage instructions, the language in communicative material exposure that makes it easy for students to understand the concept of subject matter.

The value of the next sub variable is the benefits obtained are categorized as very practical, which means students

already have the independence of learning using the Biology learning module. Then, the students also feel helped in understanding the concepts of the material being studied and think that the questions contained in the Biology learning module can be used as benchmarks to determine the level of understanding of the material they have learned.

The next practical value must be seen from a time sub variable that receives a score in the practical category by students with high and moderate cognitive levels, while the results of the questionnaire for students with low cognitive levels are categorized as very practical. This might occur because each student has a different ability to streamline his time in learning and have different learning speeds as well.

The next stage is a small group evaluation followed by a field test. In the field test/large group evaluation, practicality assessment is carried out by the teacher and students in one test class. Practicality assessment conducted by the teacher on the module shows practical categories and assessment by students shows very practical categories. This shows that the module is very practical in terms of ease of use, the benefits gained, and time efficiency. This is supported by the opinion of Plomp and Nieveen^[4] to measure the practicality of learning products that can be done by seeing whether the teacher (experts) consider that an intervention is easy and might be used by the teachers and students. With this companion learning module, teachers can facilitate students to learn independently.

Evaluation of module effectiveness could be seen from student learning outcomes which include cognitive, affective, and psychomotor aspects. The module effectiveness assessment from the cognitive aspect shows that 75% of students gave a very effective category and 25% of the students gave the effective category. This

shows that biology modules that are based on constructivism and equipped with mind maps have been effectively used as companion teaching materials in the learning process.

The evaluation of module effectiveness from the results of the affective domain assessment shows very effective criteria from each of the aspects being assessed. The aspects assessed during the learning process, namely respecting teachers and friends when talking, having curiosity, and being responsible. Of the three aspects observed and assessed, the aspects of curiosity and responsibility have the highest value compared to other aspects. This shows that the attitude of students tends to increase and influence after using the companion module in the learning process so that the companion module can be said to be effective. Rahayu^[6] states that changes in behavior in learning occur because it is preceded by a process of experience as evidenced by changes in the attitudes of students towards a better way.

The module effectiveness evaluation from the psychomotor domain assessment results shows a value of 88.9 in the highly effective category. Psychomotor assessment is carried out on projects in the form of mind maps that have been provided in the module for students to work on. Aspects observed and assessed in this realm are based on students' skills in working on mind maps, namely the use of keywords, relationships between branches, and work results/task completion.

4. CONCLUSION

The results of this study indicate that (1) constructivism-based Biology learning modules equipped with mind maps that are developed have a validity level in the valid categories, in terms of aspects of construct, content, graphics, and language; (2) Biology learning modules based on constructivism equipped with mind maps that are developed have a level of practicality in the practical category based on the results of the teacher and student practicality questionnaire with very practical categories, in terms of ease of use, benefits obtained, and time; (3) Biology learning modules based on constructivism equipped with mind maps have an effective level in the effective category based on the assessment of student learning outcomes from all three competency domains.

REFERENCES

- [1] Campbell, L. 2004. Teaching and Learning Through Multiple Intelligences, Third Edition. New York: Pearson Education.
- [2] Direktur Tenaga Kependidikan. 2008. Penulisan Modul. Jakarta: Direktorat Tenaga Kependidikan Direktorat Jenderal Peningkatan Mutu Pendidik dan Tenaga Kependidikan Departemen Pendidikan Nasional
- [3] Permendikbud No.103. 2014. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 103 Tahun 2014 tentang Pembelajaran pada

Pendidikan Dasar dan Pendidikan Menengah.
Jakarta.

- [4] Plomp, T. dan Nieveen, N. 2010. *An Introduction to Educational Design Research*. Enschede: SLO-Netherlands Institute for Curriculum Development.
- [5] Purwanto. 2014. *Prinsip-Prinsip dan Teknik Evaluasi Pengajaran*. Bandung: Remaja Rosdakarya.
- [6] Rahayu, P., S. Mulyani, dan S.S. Miswadi. 2012. "Pengembangan Pembelajaran IPA Terpadu dengan Menggunakan Model Pembelajaran Problem Base Learning Melalui Lesson Study". *Jurnal* 1:63-70.
- [7] Sudarisman, S. 2012. "Modul Berbasis Inkuiri Sebagai Penyerta pada Pembelajaran Biologi untuk Mengembangkan Kemampuan Berpikir Kritis". *Prosiding SNSMAIP III-2012*, ISBN No. 979-602-98559-1-3.
- [8] Sumiati dan Asra. 2007. *Metode Pembelajaran*. Bandung: CV. Wacana Prima.
- [9] Yusup, I. R. 2013. "Pengasaan Konsep dan Kreativitas Siswa SMA pada Materi Pokok Sistem Ekskresi Manusia Melalui Penerapan Model Project Based Learning (PjBL)". *Repository.upi.edu*. Universitas Pendidikan Indonesia.