Journal of Innovative Science Education

Development of Teaching Materials Based on Discovery Learning on Science Lessons With Adictive and Psychotropic Themes in Middle School

Riza Puji Astuti Widodo ✉, **Lisdiana, Murbangun Nuswowati**

Universitas Negeri Semarang, Indonesia

Article Info	Abstract
  	This study aims to determine the feasibility, validity and effectiveness of science learning materials based on discovery learning to improve learning outcomes and student curiosity. This research is a Research and Development (R&D) study. The model used in this study is the 4D model consists of four stages of development, namely Define (defining), Design (design), Develop (development), and Disseminate (spread). The method used in this research is observation, questionnaire, test, and documentation. The feasibility of teaching materials is obtained from the response of students and teachers to teaching materials. The validity of teaching materials is obtained from the validation of media and material experts. Effectiveness is measured by student learning outcomes and increased curiosity. The results of the study showed that discovery learning based science materials were developed appropriate, valid and effective to improve learning outcomes and students' curiosity. The N-Gain results were 0.71 with a high level of achievement, and the percentage of students' increasing curiosity attitudes was 70.12%, 79.69% and 82.03%. The results of the study concluded that science learning materials based on discovery learning were developed effectively to improve learning outcomes and students' curiosity. © 2019 Universitas Negeri Semarang

✉ Alamat korespondensi:
 Kampus Pascasarjana Unnes
Jalan Kelud Utara III, Petompon, Gajah Mungkur, Semarang, Indonesia
E-mail: rizanariza@gmail.com

Riza Puji Astuti Widodo[✉], Lisdiana, Murbangun Nuswowati/

INTRODUCTION

In the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 103 of 2014 concerning Learning in Primary and Secondary Education, it is stated that in the implementation of 2013 Curriculum it is strongly recommended to use a scientific approach with inquiry based learning models, discovery learning, project based learning, and problem based learning (Ministry of Education and Culture, 2014). Discovery learning is a learning model that is based on the principles of experiential learning. Discovery learning is a component of education that includes learning methods that promote active learning, process oriented, and self-direction (Kristian et al., 2017). Learning through direct experience creates interest in investigating and discovering new information about addictive substances and psychotropic substances. Discovery learning refers to the process in which students find their own knowledge (Mukherjee, 2015). The interest that leads to exploration or investigation in question is curiosity (Latifah & Widjajanti, 2017).

Science learning on the theme of addictive substances and psychotropics in SMP Negeri 2 Banjarharjo, Brebes still uses limited teaching materials, namely teaching materials that have not been synchronized with the learning model used in learning activities. The teaching material in question is the absence of conformity between teaching materials and the learning method used in the RPP (Learning Implementation Plan). In addition, learning activities are still teacher-centered where students have not been directly involved in learning activities. Students have not received deep knowledge and have not been directly involved in learning activities in accordance with KD 4.6. namely presenting data, information, and proposing solutions to avoid abuse of addictive substances in food and beverages as well as addictive and psychotropic substances. Even though in accordance with KD 4.6 students will be easier and more interested if the method applied is discovery learning. Apart from being directly involved by students, students will also be motivated to explore deeper knowledge, and trigger students' curiosity. Based on the research of Kemalayanti et al. (2016), the application of learning using teaching materials based on discovery learning can improve science learning outcomes. This is supported by the study of Tompo et al. (2016), that discovery learning is effective for learning use, especially for science learning.

The research conducted by Kristian (2017), the influence of discovery learning methods on mathematics learning can improve student learning outcomes. In addition to Tompo (2016), the development of the inquiry discovery learning (DI) model is effective in reducing the misconception / misunderstanding of science students at the junior high school level. The research has an equation that is using discovery learning models that can improve student learning outcomes. However, the study has not yet been recommendations for the development of teaching materials that specifically apply discovery learning models that are synchronized with instructional materials that can increase students' curiosity. So that it is necessary to develop teaching materials based on discovery learning in learning. This is supported by research by Istikomah et al. (2013), teaching materials that use the discovery learning approach, students are involved directly in learning activities and create learning processes that can provide direct experience.

Discovery learning in learning science can be seen in stages or steps of stimulation (stimulation or stimulation), problem statements (statement or problem identification), data collection (data collection), data processing (data processing), verification (verification, experiment or experiment), generalization (generalization or drawing conclusions) (Estiwi et al., 2015). Based on the research of Yerimadesi et al. (2017), integrating the discovery learning syntax into teaching materials can help teachers and students to

apply the discovery learning model in learning at school.

Teaching materials are a set of materials systematically arranged to achieve teaching and learning processes that are easily understood by students in relation to learning (Astuti, 2017). Learning activities can be supported by using teaching materials (Muzari & Prayitno, 2016). Learning by using teaching materials allows students who have high learning abilities will be faster in completing basic competencies than other students (Khabibah, 2017). Learning using teaching materials based on discovery learning can help students understand concepts, build curiosity, and be able to improve student learning skills well (Siahaan, 2017). Learning materials based on discovery learning can be used as an alternative in the learning process (Na'im et al., 2015).

Through the use of teaching materials, it is expected to be able to increase his understanding of science in solving problems. The process of developing students 'understanding using teaching materials is needed to direct the search for knowledge to actively stimulate students' curiosity in solving problems (Handoko et al., 2016). According to Arends and Ball in Latifah & Widjajanti (2017), solving problems, learning, investigating, getting new information or knowledge is an indicator of curiosity. Curiosity is the initial capital for students in the learning process. Curiosity will encourage students to fulfill their curiosity. Martin in Nurhidayanti et al. (2017), curiosity is a fundamental and very important attitude that students must have in learning science. Curiosity character is an attitude and action that always strives to know more deeply and extends from something learned, seen and heard (Ciptasari et al., 2015).

The curiosity that arises in solving problems can be done by applying teaching materials based on recovery learning. Teaching materials based on discovery learning as a solution so that students are encouraged to be directly involved in the learning process starting from orientation activities, formulating problems, submitting hypotheses, designing

investigative approaches in the form of experiments, collecting data, testing hypotheses, synthesizing knowledge, and formulating conclusions (Na 'im et al., 2015). Supported by research by Sugiarto et al. (2017), the increasing curiosity of students towards subject matter has an impact on increasing student learning achievement.

This study aims to examine the feasibility, validity and effectiveness of the application of science learning materials based on discovery learning on the theme of addictive substances and psychotropic substances that were developed to improve learning outcomes and curiosity of students of SMP Negeri 2 Banjarharjo, Brebes. From the results of this study, it is expected, can add information on the field of education, including this research is expected to be a contribution of knowledge to the world of education in overcoming the problem of learning resources by using discovery learning-based teaching materials, both for researchers and the wider community, especially in the world of education. In addition, the results of this study are expected to be a matter of consideration for teachers in applying teaching materials, especially in junior high schools, to be able to improve learning outcomes and students' curiosity. Can provide new experiences to students, and can improve understanding and achievement of student learning outcomes and increase curiosity.

METHODS

This research was conducted at SMP Negeri 2 Banjarharjo, Brebes, in March-May 2019. The research subjects were grade VIII students of SMP Negeri 2 Banjarharjo, Brebes 2018/2019 academic year with a sample of 64 students, 32 students of class VIII F as control classes and 32 students class VIII E as the experimental class.

This research was conducted using research and development (Research and Development). The development model used in this study is the 4D model suggested by Thiagarajan, Semmel and Semmel. The 4D

model consists of four stages of development, namely Define (definition), Design (design), Develop (development), and Disseminate (spread). The design phase is to collect and analyze information in the form of a preliminary study which includes literature studies and field studies. The design phase includes the preparation of instruments used in research in the form of learning devices, namely the pretest and posttest questions, syllabus, Learning Implementation Plans, material and media expert validation sheets, curiosity observation sheets, curiosity questionnaires, teacher and student response questionnaires, and discovery learning based teaching materials. The develop phase in this study is an activity that includes expert or expert validation, limited trials, and extensive trials. The disseminate process informs teaching material products to the public so that they can be used as an alternative source of learning.

Data collection techniques in this study were conducted in four ways, namely, observation, questionnaires, tests and documentation. The observation method is carried out to obtain information about activities and problems in science learning at SMP Negeri 2 Banjarharjo, Brebes. The method with the questionnaire is used to determine the response of teachers and students related to the feasibility of teaching materials. In addition, this method is also used to determine the increase in student curiosity during the learning process. The test method was conducted to determine the effectiveness of teaching materials by pre-test and post-test. The method uses documentation to obtain data in the form of values, student lists, and pictures / recordings of student activities during the learning process.

Data analysis techniques in this study used the analysis of the feasibility of teaching materials, validity and effectiveness of teaching materials. The feasibility analysis of teaching materials is carried out using questionnaires of teacher and student responses to science learning materials based on discovery learning.

The validity analysis of teaching materials is carried out using media and material expert validation of science learning materials based on discovery learning. While the analysis of the effectiveness of teaching materials by analyzing student learning outcomes and student curiosity. Student learning outcomes were analyzed based on classical completeness used to determine the percentage of success in a learning. Classroom learning is said to be successful if 75% of the number of students in the class have achieved classical completeness. Students' curiosity was analyzed based on the results of questionnaires and student observations.

RESULTS AND DISCUSSION

Feasibility of Learning Materials Based on Discovery Learning

The feasibility of teaching materials developed in terms of teacher and student responses to teaching materials based on discovery learning received a positive response. Questionnaire for student responses is given at the end of the meeting, that is, after completing the posttest. The questionnaire responses of teachers and students aim to determine the feasibility of science-based teaching materials based on discovery learning on the themes of addictive substances and psychotropic substances.

The teacher response questionnaire was filled by 7 science teachers who were presented in Table 1, including SMP Negeri 3 Banjarharjo, Brebes science teachers namely Wurti, M.Pd., Kuswiasih, S.Pd., N. Muslihah, S.Tp., S.Pd, SMP Negeri 1 Kersana, Brebes science teacher namely Dani Casriana, S.Pd, SMP Negeri 2 Kersana, Brebes 2 science teachers namely Junaedi Abdilah, S.Pd. and Euis Susilawati, M.Pd, also 1 Science teacher at SMP Negeri 3 Tanjung, Brebes, namely Ihda Hilyatunnisa, S.Pd. The feasibility of teaching materials developed based on teacher response questionnaires is presented in Table 1.

Table 1. Teacher's Response to Science Learning Materials Based on Discovery Learning

No.	Rating Item	Answer	
		Yes	No
	The cover design and appearance of teaching materials are good and interesting	7	-
	The images presented in the teaching material are clear and easy to understand	7	-
	Material on teaching materials in accordance with the development of students	7	-
	Pictures and illustrations according to the reading	7	-
	Preparation of teaching materials in accordance with Puskurbuk (Center for Curriculum and Books)	7	-
	Presentation of picture illustrations on interesting teaching materials	6	1
	The language used in teaching materials is simple and easy to understand	7	-
	Use of language in accordance with EYD, clear, and easy to understand	7	-
	Learners get new knowledge from information presented in science-based teaching materials based on discovery learning	7	-
	After learning science-based teaching materials based on discovery learning, students know more about the application of the application of addictive and psychotropic substances in daily life	7	-
	Total	69	1
	Percentage	98,57	1,43

Based on Table 1, the results of recapitulation of teacher responses to science learning materials based on discovery learning get a positive response. The percentage obtained reached 98.57% which shows a very good number.

Then the student response questionnaire was filled by 32 students after attending the lesson using science teaching materials based on discovery learning on the theme of addictive substances and psychotropics in SMP Negeri 2 Banjarharjo, Brebes. The feasibility of teaching materials developed further based on student response questionnaires is presented in Table 2.

Table 2. Student Response to Science Learning Materials Based on Discovery Learning

No.	Rating Item	Answer	
		Yes	No
	The cover design and appearance of teaching materials are good and interesting	32	-
	The images presented in the teaching material are clear and easy to understand	32	-
	Material on teaching materials according to student development	32	-
	Pictures and illustrations according to the reading	32	-
	Preparation of teaching materials in accordance with Puskurbuk (Center for Curriculum and Books)	32	-
	Presentation of picture illustrations on interesting teaching materials	32	-
	The language used in teaching materials is simple and easy to understand	30	2
	Material text and images are easy to understand	30	2
	I feel that getting new knowledge from the information presented in science teaching materials is based on discovery learning	32	-
	After learning science-based teaching materials based on discovery learning, I better know the application of the application of addictive and psychotropic substances in everyday life	25	7
	Total	309	11
	Percentage	96,56	3,44

Based on Table 2, the results of the recapitulation of student responses to learning on the theme of addictive substances and psychotropic substances using teaching materials based on discovery learning get a positive response. The percentage obtained reached 96.56% which shows a very good number. This is supported by the research of Napisa (2014) who also received a positive response from students with a percentage of 81.52%. This shows that teaching materials based on discovery learning include the types of teaching materials that are suitable for use in the learning process. Based on the teacher and student responses presented in Table 1 and Table 2, it can be seen that the feasibility of discovery learning based science materials is appropriate for use in learning.

The validity of teaching materials is obtained from the results of the validation of material experts and media experts. Validation of material experts acts as evaluator of science materials contained in the teaching materials developed. The material expert validation was carried out by 3 material expert validators,

including Dr. Woro Sumarni, M.si as material expert 1, Dr. Sri Wardani, M.Sc as material expert 2, and Wurti, M.Pd as material experts 3. Validation of material in teaching materials consists of 3 aspects including aspects of content or material, aspects of material presentation, linguistic aspects. Based on the results of the expert validation recapitulation of IPA teaching material based on discovery learning on the theme of addictive substances and psychotropic substances it is said to be valid, namely 85.94%. Validation of media experts acts as an evaluator of the feasibility aspects of media in teaching materials in terms of graphic aspects. developed. Media expert validation was carried out by 3 material expert validators, including Dr. Woro Sumarni, M.si as media expert 1, Dr. Sri Wardani, M.Si as media expert 2, and Maryono, M. Kom as media experts 3. The results of recapitulation of media expert validation on science learning materials based on discovery learning on the theme of addictive substances and psychotropic substances are said to be worth 88.73%.

The effectiveness of discovery learning based materials is measured from the classical completeness of the post-test results after the use of discovery learning-based teaching materials. Teaching materials are said to be effective if classical completeness is more than 75% or in other words can be disclosed at least 75% of students reach KKM.

The results of the post-test recapitulation in the control class after learning activities, there were 14 of 32 students who achieved KKM or classical completeness were around 43.75%. With N-Gain as much as 0.42. If viewed from these results, the control class learning has success in the medium category. While the results of the post-test recapitulation in the experimental class after the use of discovery learning based teaching materials can be seen that there were 27 out of 32 students who achieved KKM or classical completeness were around 84.37%. With N-Gain it is 0.71. If viewed from these results, then learning with teaching materials based on discovery learning has success in the high category.
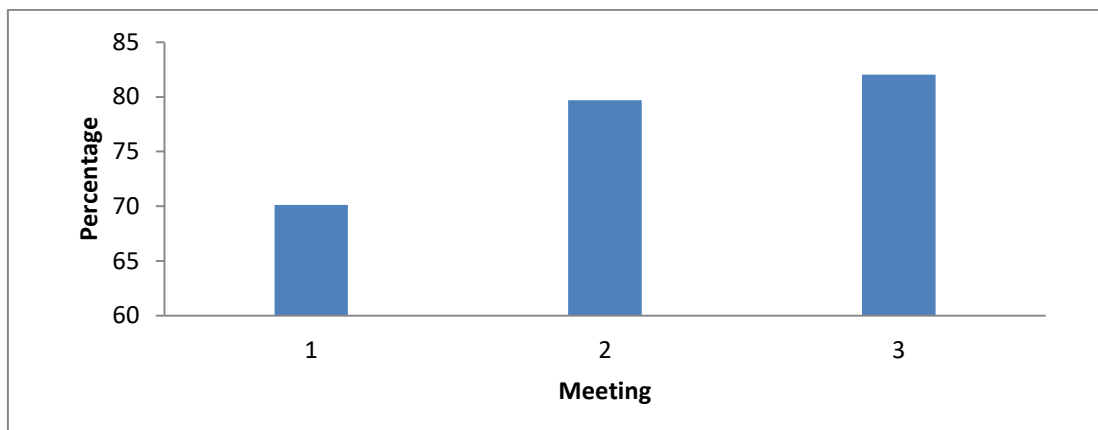
The effectiveness of further teaching materials, namely the curiosity of students in learning activities using science teaching materials based on discovery learning on the theme of addictive substances and psychotropic substances can be said to be very good. With the percentage of questionnaires students get 95.57% with very good categories. In addition, the effectiveness of curiosity is done using observation of students' curiosity. Observation of students' curiosity was carried out by Anna Setyo Wijayanti, S.Pd as an observer. The curiosity observation sheet consists of 4 assessment indicators. The observation results of students' curiosity are presented in Table 3.

Table 3. Observation of Student Curiosity

No. Indicator	Score		
	Meeting 1	Meeting 2	Meeting 3
Enthusiastic looking for answers	85	98	98
Attention to the object being observed	91	102	111
Enthusiastic about the science process	91	109	107
Asking about each step of the activity	91	99	104
Total	359	408	420
Percentage	70,12	79,69	82,03
Criteria	Good	Good	God

Based on Table 3. it can be concluded that the observation of students' curiosity in learning activities using science teaching materials based on discovery learning on the theme of addictive substances and psychotropic substances can be said to be good. With the observation percentage the students' curiosity at the first meeting was obtained 70.12%, experiencing an increase in the second meeting to 79.69%, then at the third meeting it increased to 82.03%.

Figure 1. Increased Observation of Student Curiosity

Based on observations made by observers, data obtained on Figure 1. were in the form of an increase in the percentage of curiosity of students at each meeting, so that students' curiosity to use teaching materials based on discovery learning was stated to increase.

CONCLUSION

The researcher concludes that science-based teaching materials based on discovery learning on the theme of addictive substances and psychotropic substances developed have been feasible, valid and effective. For further research, it is expected to be a consideration and reference in applying teaching materials, especially in junior high schools, to be able to improve learning outcomes and students' curiosity. In addition, it is expected that teaching materials can be packaged in electronic forms such as cellphones or computers and can be developed again so that student learning outcomes and curiosity can be increased even higher.

REFERENCES

Astuti, S. (2017). Pengembangan Bahan Ajar Matematika dengan Model *Discovery Learning* untuk Meningkatkan Kemampuan Pemahaman Prinsip-Prinsip Matematika dan Kemampuan Penalaran Logis Siswa Di SMAN 1 Jarai Kabupaten Lahat. *Jurnal Pendidikan Matematika*, 5(1), 71-75.

Ciptasari, D., Nuswowati, M., & Sumarni, W. (2015). Pembelajaran Zat Adiktif dan Psikotropika Berpendekatan *Contextual Teaching and Learning* Untuk Mengembangkan Karakter Rasa Ingin Tahu Siswa. *Unnes Science Education Journal*, 4(1), 756-762.

Estiwi, E,. Raharjo, T.R., & Syamwil, R. (2015). Pengembangan Model Pembelajaran Tematik Berbasis *Discovery Learning* Untuk Memperkenalkan Konsep Sains. *Journal of Primary Education*, 4(1), 10-14.

Handoko, A., Sajidan, & Maridi. (2016). Pengembangan Modul Biologi Berbasis Discovery Learning (Part Of Inquiry Spectrum Learning-Wenning) Pada Materi Bioteknologi Kelas XII IPA Di SMA Negeri 1. *Jurnal Inkuiri, 5*(3), 144–154.

Istikomah, Hartono, & Rusilowati, A. (2013). Pengembangan Perangkat Pembelajaran Metode *Discovery Learning* Untuk Pemahaman Sains Pada Anak TK B. *Journal of Primary Educational*, 2(2), 71-7.

Kemalayanti, N. M. I., Suniasih, N. W., & Ganing, N. (2016). Penerapan Model Pembelajaran Discovery Berbasis Karakter Untuk Meningkatkan Hasil Belajar IPA Tema Tempat Tinggalku. *E-Journal PGSD Universitas Pendidikan Ganesha Jurusan PGSD*, 4, 1–10.

Kemendikbud. (2014). *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 103 tahun 2014 tentang Kurikulum 2013 Sekolah Menengah Atas/Madrasah Aliyah*. Jakarta: Kemendikbud.

Khabibah, E. N. (2017). The Effectiveness of Module Based on Discovery Learning to Increase Generic Science Skills. *Journal of Education and Learning,* 11(2), 146-153.

Kristian, A., Armanto, D., & Sudrajat, A. (2017). The Effect Of Discovery Learning Method On The Math Learning Of The V SDN 18 Students Of Banda Aceh, Indonesia. *British Journal of Education*, 5(11), 1-11.

Latifah, U. H. & Widjajanti, D. B. (2017). Pengembangan Bahan Ajar Statistika dan Peluang Berbasis *Multiple Intelligences* Berorientasi pada Prestasi, Pemecahan Masalah, dan Rasa Ingin Tahu. *Jurnal Riset Pendidikan Matematika*, 4(2), 176-185.

Mukhrejee, A. (2015). Effective Use of Discovery Learning to Improve Understanding of Factors That Affect Quality. *Journal of Education for Business*, 90(8), 413–419.

Muzari, I. & Prayitno, B. A. (2016). Pengembangan Modul IPA Terpadu Berbasis SETS pada Tema Makanan Sehat dan Tubuhku untuk Meningkatkan Hasil Belajar. *Jurnal Inkuiri,* 5(1), 21–27.

Na'im, M. A., Sopyan, A., & Linuwih, S. (2015). Implementasi Model Discovery-Inquiry Berbasis Pendekatan Scientific pada Pembelajaran IPA di Kelas V Sekolah Dasar. *Journal of Primary Education*, 4(2), 104-111.

Nurhidayanti, A, Zuhdan, K.P., & Widowati, A. (2017). Pengembangan LKPD IPA Berbasis Inkuiri Terbimbing Strategi Metakognisi untuk Meningkatkan Hasil Belajar Kognitif dan Rasa Ingin Tahu Peserta Didik. *Jurnal Pendidikan Matematika dan Sains,* 6(4), 224-230.

Siahaan, F. B. (2017). Application of Discovery Learning Model for Solving System of Linear Equations Using GeoGebra. *International Journal of Applied Engineering Research*, 12(19), 9195–9198.

Sugiarto, D. H., Suryadi, B. U., Nugroho, A. C. S., & Paerah. (2017). Penerapan Model Pembelajaran *Quantum Teaching* untuk Meningkatkan Rasa Ingin Tahu dan Prestasi Belajar Siswa pada Materi Koloid Kelas XI IPA SMA Negeri 3 Boyolali Tahun Pelajaran 2015/2016. *Jurnal Pendidikan Kimia,* 6(1), 24-30.

Tompo, B., Ahmad, A., & Muris, M. (2016). The Development of Discovery-Inquiry Learning Model to Reduce the Science Misconceptions of Junior High School Students. *International Journal of Environmental & Science Education*, 11(12), 5676-5686.

Yerimadesi, Putra, A. & Ririanti. (2017). Efektivitas Penggunaan Modul Larutan Penyangga Berbasis *Discovery Learning* Terhadap Hasil Belajar Siswa Kelas XI MIA SMAN 7 Padang. *Jurnal Eksakta Pendidikan*, 1(1), 17-23.