



Development of Learning Tools Based on Discovery Learning Models Combined with Cognitive Conflict Approaches to Improve Students' Critical Thinking Ability

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Abstract: Critical thinking is an important skill that needs to be developed in students, including vocational high school students. The critical thinking skills of students who are well facilitated in the learning process will be very useful for students' future. This study aims to develop and implement learning tools that combine discovery learning models with cognitive conflict approaches so that they have a good impact on students' critical thinking skills on heat material. The development of this learning tool adapted the 4D model which consisted of define, design, develop, and disseminate. The learning tools are in the form of syllabus, lesson plans, student worksheets, and evaluation instruments in the form of descriptions to measure students' critical thinking skills. This research was carried out at Mataram State Vocational High School 4 in the academic year 2018/2019. The results showed that this learning device obtained a very high level of validity based on an assessment by an expert validator and obtained a high level of practicality based on observations of the implementation of learning and the results of filling out the questionnaire by students. Students' critical thinking skills are also classified as high criteria based on the measurement results of the evaluation of learning. It can be concluded that the developed learning device is valid, practical, and has a good impact on students' critical thinking skills.

Keywords: Discovery Learning Model; Cognitive Conflict Approach; Critical Thinking Ability; Heat

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Introduction

Discovery learning model is a collection of learning activities that give students an emphasis on the ability to prove hypotheses actively and independently (Bailin et al., 2018) through the process of observation and experiment (Kunsting et al., 2013, Kistner et al., 2016). The application of this learning model will give students direct experience so that the learning process will be more meaningful. Direct learning and experience

when learning tends to be preferred by vocational students (Lestari et al., 2019).

The learning process in the classroom is certainly not enough if only applying the learning model. Therefore, an approach in the learning process is also needed. One approach to learning that is needed is the cognitive conflict approach. Cognitive conflict approach is an approach that is applied in learning with the aim to equalize students' conceptions. This conceptual

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alignment is done by making students doubt the wrong conceptions that they consider right up to now.

The application of this approach is presented in the form of questions relating to phenomena in students' daily lives and then asks students to analyze them scientifically. The application of this approach will stimulate students to think deeply and stimulate students' ability to think critically. Critical thinking skills are thought processes that allow students to evaluate the assumptions, evidence, and logic that underlie the statements of others (Ihsan et al., 2019, Zulkarnain et al., 2019, Aini et al., 2018).

Based on observations from the Vocational High School 4 Mataram, information was obtained that the facilities and infrastructure at this school were still incomplete. This can be seen from the unavailability of natural science laboratories accompanied by a limited number of laboratory equipment and materials. Whereas Vocational High School students are students who tend to be more interested in the learning process that is applicable and accompanied by practicum.

The application of learning material that uses direct practice is an activity that is highly needed by students at the Vocational Schools (Emir, 2013). This certainly becomes an obstacle in the learning process that causes students difficulty in getting direct practice through practicums and inhibits the provision of stimulus to spur students to think critically.

In addition to the constraints of facilities and infrastructure, learning tools are also needed that can provide facilities for students to think at a high level. The application of various learning models is useful for increasing motivation for students to think at a higher level (Kusumaningrum et al., 2019, Yang, 2015). One learning model that is able to meet these criteria is a discovery learning model that is supported by the cognitive conflict approach.

Previous researchers stated that the discovery learning model is able to train students' critical thinking skills (In'am, & Hajar, 2017) and increase students' mastery of concept concepts (Wahyuni et al., 2018, Kartini, 2019). In addition to the discovery learning model, the cognitive conflict approach also has a positive influence on students' critical thinking abilities (Fatimah et al., 2016, Lestari et al., 2015, Istiqamah, 2016). Based on this, it appears that the discovery learning model and cognitive conflict approach have in common that is a positive impact on students' critical thinking skills.

The combination of discovery learning models and cognitive conflict approaches is considered quite appropriate and complementary in training and improving students' ability to think critically. Based on this, researchers feel interested in developing learning tools that combine discovery learning models with

cognitive conflict approaches. The purpose of developing this learning tool is to improve students' ability to think critically.

Method

This research is a development study that adopts a 4D model consisting of the stages of define, design, develop, and disseminate. The development carried out is the development of learning tools that combine discovery learning models with cognitive conflict approaches. The results of these combinations produce new learning steps which are then applied in the learning process.

The components of the developed learning kit consist of syllabus, Learning Implementation Plan, Student Worksheets, and questions about critical thinking skills in the form of questions in the form of a description of five items. This research was only carried out until a limited trial and continued with the process of measuring student learning outcomes of students' critical thinking skills after giving treatment.

This study uses a pre-experimental design in the form of one-shot case study. This design uses a group that is given treatment then continued with the process of observation or observation of the results obtained. In this study, the independent variable used is discovery learning model combined with cognitive conflict approach, while the dependent variable is students' critical thinking abilities. The design of this research design is shown in Table 1.

Table 1. Desain One-Shot Case Study

Treatment	Post Test
X	O

(Sumber: Sugiyono, 2014)

Where:

X = Treatment given

O = Observation (dependent variable)

This research was carried out at Mataram State Vocational High School 4 in the academic year 2018/2019. The class studied was class X UPW 1, amounting to 29 students. This research took place during three meetings on the subject matter of heat. After the whole learning process is completed during the three meetings, it is then that students are asked to complete five item questions as an instrument to measure critical thinking skills.

Each item given to students represents each indicator of critical thinking ability consisting of elementary clarification, basic support, advance clarification, strategy and tactics, and inference. The data from the measurement of students' critical thinking

abilities that have been obtained are then grouped using two methods. The intended method is grouping student grades in general and grouping student grades based on each indicator of critical thinking ability.

Result and Discussion

The development of learning tools that use discovery learning models and cognitive conflict approaches has passed the process of validity and practicality testing. The validity test results show that the learning tools developed are classified as very valid criteria. The results were obtained based on the results of filling out the validation test questionnaire by three expert validators. The results are then averaged and classified according to criteria for the level of validity.

The practicality test results show that the device developed is classified as a very practical criterion. These results were obtained based on observations of the implementation of learning and the results of student responses. Data from observations of learning performance were taken in class X UPW 1 for three meetings. Retrieval of data from observations of the implementation of learning is done at each meeting by an observer. Retrieval of student response data is carried out at the third meeting, precisely at the end of the learning process. Student response data is obtained by giving questionnaires to each student and students are given a few minutes to fill out the questionnaire that has been given.

After all the learning processes are completed, the data collection is continued by measuring the level of students' critical thinking skills. The measurement of students' critical thinking skills is done by giving students time to complete five items of description related to heat material. Before it is given to students, the description of the question has previously gone through the test instrument test process. Acquiring the final value of students' critical thinking skills in general can be seen in Table 2.

Tabel 2. Student Final Grades

No.	Class	Number of students	Average
1.	X UPW 1	29	88.83

Table 2 shows that learning devices that use discovery learning models with cognitive conflict approaches have a positive impact on students' critical thinking skills. It also appears that the average grade of students has exceeded the Minimum Completion Criteria. The acquisition can occur because the items to measure students' critical thinking skills are dominated by the applicative description questions in the form of questions relating to the application of the concept of

heat in the daily life of students and in accordance with the majors in Vocational High School 4 Mataram.

This certainly attracts students' interest and enthusiasm in working on problems, because the type of applicative questions is a matter of interest and feels appropriate to be given to vocational high school students (Lestari et al., 2019).

In addition to general explanation, the value of students' critical thinking skills is also classified based on each indicator. There are five indicators of critical thinking skills. The indicators consist of elementary clarification, basic support, advance clarification, strategy and tactics, and inference. The student's final grade on each indicator is shown in Figure 1.

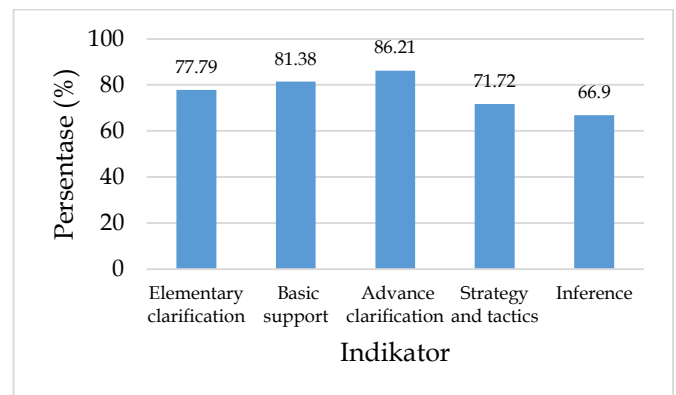


Figure 1. Student Final Grades Per Critical Thinking Ability Indicator

Based on Figure 1, it appears that the final value of students' critical thinking skills in the advance clarification indicator obtained the highest percentage among the percentage of the acquisition of other indicators that is equal to 86.21%, so it is classified in the very high category. This value is classified as very high criteria because it is in the range of values 81-100% (Sugiyono, 2014). This advance clarification indicator is represented by question number 1. Problem number 1 contains a graph about the change in the form of substances that is equipped with each phase of the change in the form of substances. In this problem students are asked to explain each phase based on the graph provided.

Percentage of student acquisition on problems with advance clarification indicators can occur because students are familiar with the graphs presented. In addition, an explanation of each phase of changing forms on this graph is quite often presented by the teacher during the learning process. In other words, students are already familiar with repetitive information related to the graph, so that when the problem is presented to students, students will be triggered by their memory to solve problems and produce maximum results.

The percentage of student acquisition on questions with advance clarification indicators is contrary to the results of research from Qurniati et al., (2015) which states that discovery learning has no effect on increasing students' critical thinking skills on the advance clarification indicator. This can be seen in the results of the N-gain calculation that shows the critical thinking ability of students in the advance clarification indicator lies in the range of values lower than the existing categorization.

Several other researchers also explained the results of their research related to discovery learning models. The intended results are the results that support the results of this study and state that the discovery model has a positive influence on students' critical thinking skills (Zakrah et al., 2015, Suryadi et al., 2015, Rizaldi, 2019). In addition, the implementation of the cognitive conflict approach in the learning process tends to position students in the high category (Yonata et al., 2016), the development of the resulting devices is classified as practical and valid, and feasible to be applied to learning in schools (Makhrus et al., 2014, Susilawani, 2019).

Conclusion

Based on the results of research and discussions that have been conducted, it was found that the learning tools developed using discovery learning models and cognitive conflict approaches have a positive impact on the critical thinking skills of vocational students, especially on heat material. Therefore, it can be concluded that the learning process that applies learning tools developed with discovery learning models and cognitive conflict approaches is feasible, practical, and appropriate to be applied in the classroom to improve students' critical thinking skills.

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References

- Aini, Z., Ramdani, A., & Raksun, A. (2018). Perbedaan Penguasaan Konsep Biologi dan Kemampuan Berpikir Kritis Siswa Kelas X pada Penerapan Model Pembelajaran Kooperatif Tipe Group Investigation dan Guided Inquiry di MAN 1 Praya. *Jurnal Pijar MIPA*, 13 (1), 19-23. doi: <http://dx.doi.org/10.29303/jpm.v13i1.466>
- Aminah, S., Doyan, A., Hikmawati, 2020. Pengaruh Model Pembelajaran Quantum dengan Bantuan Simulasi PHET Terhadap Kemampuan Berpikir Kritis Peserta Didik, *Pijar Mipa*, 15 (3), 293-397, doi: <http://dx.doi.org/10.29303/jpm.v15i3.1531>
- Bailin, K., Jahre, B., & Morris, S. (2018). *Planning Academic Library Orientations*. Chicago: Elsevier Limited.
- Emir, O. (2013). The Effect of Training on Vocational High School Students in Their Professional Development. *Procedia-Social and Behavioral Science* 106, 2274-2738. doi: 10.1016/j.sbspro.2013.12.313
- Fatimah, N., Gunawan, & Wahyudi. (2016). Pembelajaran Berbasis Masalah dengan Strategi Konflik Kognitif terhadap Penguasaan Konsep dan Kemampuan Berpikir Kritis Fisika Peserta didik Kelas XI SMKN 1 Lingsar Tahun Pelajaran 2015/2016. *Jurnal Pendidikan Fisika dan Teknologi*, 2 (4), 183-190. doi: <http://dx.doi.org/10.29303/jpft.v2i4.423>
- Ihsan, M.S., Ramdani, A., & Hadisaputra, S. (2019). Pengembangan E-Learning pada Pembelajaran Kimia untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik. *Jurnal Pijar MIPA*, 14 (2), 84-87. doi: <http://dx.doi.org/10.29303/jpm.v14i2.1238>
- Istiqamah, N., Doyan, A., Taufik, (2016). Pengaruh Model Pembelajaran Discovery Dan Inkuiri Terbimbing Berbasis Eksperimen Terhadap Hasil Belajar Fisika Dan Sikap Ilmiah Siswa, *Jurnal Penelitian Pendidikan IPA*, 2(1), 27-38, doi: <https://doi.org/10.29303/jppipa.v6i1.290>
- In'am, A., & Hajar, S. (2017). Learning Geometry through Discovery Learning Using a Scientific Approach. *International Journal of Instruction*, 10 (1), 55-70.
- Kartini, Doyan, A., Kosim, Susilawati, Khasanah, B.U., Hakim, S., Muliyadi, L., (2019). Analysis of Validation Development Learning Model Attainment Concept to Improve Critical Thinking Skills and Student Learning Outcomes, *Jurnal Penelitian Pendidikan IPA*, 5(2), 185-188, doi: [10.29303/jppipa.v5i2.262](https://doi.org/10.29303/jppipa.v5i2.262)
- Kistner, S., Vollmeyer, R., Burns, B. D., & Kortenkamp, U. (2016). Model Development in Scientific Discovery Learning with a Computer-Based Physics Task. *Computers in Human Behavior* 59, 446-455. doi: <https://doi.org/10.1016/j.chb.2016.02.041>
- Kusumaningrum, I., Hidayat, H., Ganefri, A.S., & Dewy, M. S. (2016). Learning Outcomes in Vocational Education: A Business Plan Development by Production-Based Learning Model Approach. *International Journal of Environmental and Science Education*, 11 (18), 11917-11930.

- Kunsting, J., Kempf, J., & Wirth, J. (2013). Enhancing Scientific Discovery Learning Through Metacognitive Support. *Contemporary Educational Psychology* 38, 349-360.
- Lestari, P. A. S., Gunawan., & Kosim. (2019). Model Pembelajaran Discovery dengan Pendekatan Konflik Kognitif Berorientasi pada Kemampuan Berpikir Kritis Peserta Didik. *Jurnal Pendidikan Fisika dan Teknologi*, 5 (1), 118-123. doi: <http://dx.doi.org/10.29303/jpft.v5i1.1161>
- Lestari, P.A.S., Rahayu, S., & Hikmawati. (2015). Profil Miskonsepsi Siswa Kelas X SMKN 4 Mataram pada Materi Pokok Suhu, Kalor, dan Perpindahan Kalor. *Jurnal Pendidikan Fisika dan Teknologi*, 1 (3), 146-153. doi: <http://dx.doi.org/10.29303/jpft.v1i3.251>
- Makhrus, M., Nur, M., & Widodo, W. (2014). Model Perubahan Konseptual dengan Pendekatan Konflik Kognitif (MPK-PKK). *Jurnal Pijar MIPA*, 9 (1), 20-25. doi: <http://dx.doi.org/10.29303/jpm.v9i1.39>
- Qurniati, D., Andayani, Y. & Muntari. (2015). Peningkatan Keterampilan Berpikir Kritis Melalui Model Pembelajaran Discovery Learning. *Journal Penelitian Pendidikan IPA*, 1 (5), 58-69. doi: <https://doi.org/10.29303/jppipa.v1i2.20>
- Rizaldi, D. R., Makhrus, M., Doyan, A., 2019. Analisis Tingkat Kemampuan Berpikir Kritis Dengan Model Perubahan Konseptual Ditinjau Dari Gaya Belajar Siswa, *Jurnal Pendidikan Fisika dan Teknologi*, 5(1), 74-81, doi: [10.29303/jpft.v5i1.794](https://doi.org/10.29303/jpft.v5i1.794)
- Sugiyono. (2014). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R & D*. Bandung: Alfabeta.
- Suryadi, A., Ali, M.S. & Rusli, M.A. (2015). Peranan Strategi Pembelajaran Konflik Kognitif Terhadap Pemahaman Konsep Fisika Peserta Didik Madrasah Aliyah Negeri Pangkep. *Jurnal Sains dan Pendidikan Fisika*, 11 (2), 141-149. doi: <https://doi.org/10.35580/jspf.v11i2.1480>
- Susilawani, Doyan, A., Ayub, S., (2019). Perbedaan Keterampilan Generik Sain Antara Model Pembelajaran Berbasis Masalah Dengan Inkuiri Terbimbing Ditinjau Dari Kemampuan Berpikir Kritis Siswa SMA. *Jurnal Pendidikan Fisika dan Teknologi*, 5(1), 16-24, doi: <http://dx.doi.org/10.29303/jpft.v5i1.887>
- Wahyuni, S., Kosim, & Gunawan. (2018). Pengembangan Perangkat Pembelajaran Fisika Berbasis Inkuiri Terbimbing Berbantuan Eksperimen untuk Meningkatkan Penguasaan Konsep Peserta Didik. *Jurnal Pendidikan Fisika dan Teknologi*, 4 (2), 240-246. doi: <http://dx.doi.org/10.29303/jpft.v4i2.891>
- Yang, Y.C. (2015). Virtual CEOs: A Blended Approach to Digital Gaming for Enhancing Higher Order Thinking and Academic Achievement among Vocational High School Students. *Computer and Education* 81, 281-295. doi: <https://doi.org/10.26858/est.v1i1.7001>
- Yonata, P., Amalia P., & Hufri. (2016). Desain Perangkat Pembelajaran Fisika Berorientasi Strategi Konflik Kognitif pada Konsep Kalor di Kelas X SMA/MA. *Pillar of Physics Educational* 8, 89-96. doi: <http://dx.doi.org/10.24036/2468171074>
- Zakrah, Z., Nur L., & Kusmivati. (2015). Pengaruh Strategi Pembelajaran Discovery terhadap Kemampuan Berpikir Kritis Peserta Didik Pada Mata Pelajaran IPA Kelas VIII di SMPN 3 Gunungsari Tahun Ajaran 2014/2015. *Jurnal Pijar MIPA*, 10 (1), 57-63. doi: <http://dx.doi.org/10.29303/jpm.v10i2.31>
- Zulkarnain, Z., Andayani, Y., & Hadisaputra, S. (2019). Peningkatan Keterampilan Berpikir Kritis Peserta Didik pada Pembelajaran Kimia Menggunakan Model Pembelajaran Preparing Dong Concluding. *Jurnal Pijar MIPA*, 14 (2), 96-100. doi: <http://dx.doi.org/10.29303/jpm.v14i2.1321>