IJECA
International Journal of
Education & Curriculum Application
http://journal.ummat.ac.id/index.php/IJECA
ISSN 2614-3380 | Vol. 3, No. 2, August 2020

The Effect of Discovery Learning Model Using Concept Map and Computer Animation on Student Learning Outcomes in Hydrocarbon Material

Anita Debora Br. Simangunsong
Universitas HKBP Nommensen Pematangsiantar, Indonesia
anitadebora715@gmail.com

Keyword:

Discovery learning;
Concept maps;
Computer animation;
Learning outcomes.

ABSTRACT

This study aims to determine the effect of discovery learning with concept maps and computer animation media on chemistry learning outcomes on the subject of hydrocarbons. The sample in this study was students of Mathematics Education semester 1 HKBP Nommensen Pematangsiantar University odd semester of the 2019/2020 school year. The instrument used in data collection is a validated test instrument. The data obtained were tested with a comparative study using the two-party t test. From the normalized gain data, a large increase in student learning outcomes by using discovery learning teaching with concept maps and computer animation media was 54% of the experimental class I and 70% of the experimental class II. The magnitude of the difference in the increase in student learning outcomes is 16%. Based on the results of hypothesis testing, obtained tcount> ttable is 5.56> 1.6671 at a significant level α = 0.05. This means that H0 is rejected and Ha is accepted, which states that there are significant differences in student learning outcomes by applying discovery learning using concept maps and computer animation on hydrocarbon material.

Article History:
Received: 30-07-2020
Revised : 05-08-2020
Accepted: 06-08-2020
Online : 12-08-2020

https://doi.org/10.31764/ijeca.v3i2.2692

A. INTRODUCTION

Education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop their potential. The educational experience often faced by chemistry teachers is that most students have difficulty understanding and taking chemistry lessons. (Nbina & Obomanu, 2010) said that individuals who understand scientific literacy, including chemistry, need intellectual abilities such as high thinking skills, good attitude skills, social skills and good interdisciplinary skills. This situation causes students to assume that chemistry is a difficult subject.

One alternative answer to the problem above, educators can choose learning strategies through discovery learning, namely the learning process that occurs is not presented with lessons in its final form, but is expected to organize itself. In this connection students can fully realize what the meaning of learning, its benefits, how to strive to achieve it and can understand that what they learn is useful for future life. Discovery occurs when individuals are involved,

especially in the use of mental processes to find several concepts and principles. Discovery is done through observation, classification, measurement, prediction, determination and inference.

Based on the results of (Saputra & Nofita, 2018) shows that the learning discovery model assisted by macromedia flash animation media can increase student activity in SMP Negeri 1 Suhaid. Research that supports the success of the use of discovery learning is (Kurnianto et al., 2015), where the posttest results of the experimental class I was 76.3 and experiment II was 74.4 while the control class was 67.3. In research (Catur Saputro, Istiana, et al., 2015) increased mastery learning achievement in the first cycle is 70% and the second cycle is 85%. Assisted by other studies where groups of students who took discovery learning got an average score of learning outcomes of 74.70 while groups of students who took conventional learning amounted to 70.38 (Putrayasa et al., 2014). As said (Swaak et al., 2004) associated with the study that discovery learning increases students' understanding of prior knowledge and increases student activity. According to (Tumurun et al., 2016) learning with discovery learning models is better able to improve students creative thinking skills.

As for the media, it is considered to be able to attract the attention of students when following the learning process. The media that will be used in these research concept maps and animations. The excellence of animation media has the ability to explain an event systematically in a time of changing and making abstract learning material more accurate. According to (Oktarini et al., 2014) animation media is more effective in increasing student learning outcomes than image media.

One of the tools that is thought to be effective is the concept map. Concept maps are personal learning aids where students construct concept maps using their own terms so that they need to be further confirmed (Miller et al., 2009). One of them is the use of concept map media which has been proven to be able to increase learning in accordance with the contents of (Ismail et al., 2013) where student learning outcomes in the second cycle have been improved from cycle 1 namely from 80.09% to 85.79%, has experienced an increase in mastery learning ≥ 75%. (Boujaoude & Attieh, 2008) conducted a similar study, where the concept map score with the post-test score showed a significant correlation. Linking the use of discovery learning with the concept map media obtained the results of the experimental class 2 is greater than the experimental class 1 namely 57.22% and 39.16% (Setiyawan & Indrowati, 2014).

For the second medium, animation media, which has been proven in the research of (Hatika, 2016), where the average absorption capacity in the experimental class uses computer animation media with an effectiveness percentage of 80.03% while in the control class only 78.7%. Other studies using animation media mention the average value of students' cognitive learning achievement taught with animation media by 89.13 better than the average value of student achievement taught with LKS media that is equal to 84.19 (Catur Saputro, Puspitasari, et al., 2015). Related research using discovery learning assisted with animation media get good results, namely the average value of the experimental class is greater than the average value of the control class with a number of 65.44 and 56.18 (Fitriani et al., 2014). Based on the description and thoughts above, the researcher is interested in conducting research with the title: "The Effect of the Discovery Learning Model Using Concept Maps Media and Computer Animation on Student Learning Outcomes on Hydrocarbon Material".

B. METHODS

This research was conducted at HKBP Nommensen Pematangsiantar University. The study population was all students of Mathematics Education at HKBP Nommensen Pematangsiantar University. In this study, the sample was taken by random sampling, namely Mathematics Education students, where researchers took samples for this study as group A and group B. The first sample used as experimental class I was given discovery learning using concept mapping media. While the second sample used as experimental class II was given discovery learning using computer animation media.

This study involved two experimental classes that were given different treatments. In the experimental class I was given treatment that is by giving discovery learning with concept map media on the material while in experimental class II by giving discovery learning learning with computer animation media. The material used was hydrocarbons. The research design is presented in the table.

Table 1. Research design

No	Learning outcomes	Discovery Learning Learning with Concept Map Media (B1)	Learning Discovery Learning with Computer Animation Media (B2)
1	Height (A1)	A_1B_1	A_1B_2
2	Low (A2)	A_2B_1	A_2B_2

Information:

A1B1 : High learning outcomes with the use of discovery learning, learning with concept map media
A2B1 : Low learning outcomes with the use of discovery learning learning with concept map media
A1B2 : High learning outcomes with the use of discovery learning learning with computer animation media
A2B2 : Low learning outcomes with the use of discovery learning, learning with computer animation media

Research instruments to determine learning outcomes consist of test instruments namely multiple choices with options (a, b, c, d, e). In order to process data, the following steps are taken: providing a pre-test to measure initial capabilities; before being given treatment, students are given teaching in Group A class using concept map media and Group B class using computer animation media; throughout the research process, keep the class conditions the same, for example teaching staff, books used, length of time for teaching and so on; provide post-test to measure improvement in learning outcomes in class; analyze data by conducting statistical tests and make conclusions based on the results of data analysis. The hypothesis test used in this study is a hypothesis test using the two-party t test and an increase in student learning outcomes seen by using gain.

C. RESULT AND DISCUSSION

Before the two groups of samples were given different treatments, firstly they were given a pretest which aimed to test homogeneity and normality and to know the picture about the initial abilities of each student in both classes. Based on the results of the study after the calculation is obtained the average pretest, posttest, standard deviation in the table below.

Based on the results of the pretest obtained an average pretest value for experimental class 1 of 28.125 with the highest value of 45 and the lowest value of 10 with a standard deviation of 8.29. Whereas the posttest value obtained an average value of 67.25 with the highest score being 80 and the lowest value of 50 and the standard deviation of 6.40. Meanwhile, the average pretest

value for experimental class 2 was 29.25 with the highest value 45 and the lowest value was 10 and the standard deviation was 9.02. As for the posttest value obtained an average of 79.5 with the highest value of 90 and the lowest value of 65 and a standard deviation of 5.28. Based on the results of the study after the calculation is obtained the average pretest, posttest, standard deviation as stated in the average Table 2 ($\overline{X}$) and standard deviation (SD).

Table 2. Average and Standard Deviation

No	Name	Pretes	Postes
1	Experiment 1	$\overline{X}$ =28,125 SD = 8,29	$\overline{X}$ = 67,25 SD = 6,40
2	Experiment 2	$\overline{X}$ = 29,25 SD = 9,02	$\overline{X}$ = 79,5 SD = 5,28

To test whether the data obtained in this study are normally distributed or not, it can be tested with the chi-square test (X^2 table) at a significant level, α = 0.05 and obtained data as stated in Table 3.

Table 3. Pretest Data Normality Test Table

No	Class	X^2 account	X^2 table
1	Experiment 1	8,614	11,07
2	Experiment 2	9,928	11,07

From the table, it can be seen that the pretest data obtained in the study is normally distributed, where X^2 count of experimental class 1 is 8.614 and X^2 count of experimental class 2 is 9.928, smaller than X^2 table, which is 11.07.

Table 4. Post-test Data Normality Test table

No	Class	X^2 hitung	X^2 tabel
1	Eksperimen 1	9,742	11,07
2	Eksperimen 2	5,571	11,07

From Table 4 it can be seen that the post-test data obtained in the study were normally distributed in which X^2 count experimental class 1 was 9.742 and X^2 count experimental class 2 was 5.571 smaller than X^2table which was 11.07.

To test whether the sample comes from a homogeneous population used two variance similarity test. From the results of homogeneity test calculations obtained data as stated in table 5.

Table 5. Homogeneity Test

Class	S^2	F.count	F-table
Eksperimen 1	68,72	1,18	1,795
Eksperimen 2	81,36	1,18	1,795

Test criteria are if F-count < F-table, it can be declared homogeneous at a significant level α = 0.05. Based on the table above it can be seen that F-count < F-table so that it can be stated that both sample groups have homogeneous variance.

Based on the calculation of normalized gain in experimental class 1 it is concluded that the average experimental class 1 falls into the medium gain category (g = 0.54), in experimental class 2 the average experimental class 2 falls into the high gain category (g = 0 , 70). Then it can be concluded that the increase in learning outcomes of experimental class 2 students is higher

than the learning outcomes of experimental class 1. The magnitude of the difference in the increase in learning outcomes of experimental class 2 students with experimental class 1 is 16%.

The hypothesis in this study as stated earlier is as follows:

Ha: There are significant differences in student learning outcomes by applying discovery learning using concept maps and computer animation on hydrocarbon material.

To test the hypothesis, a two-party t-test is used using normalized gain data. Ha is accepted if t> t table, at the level of α = 0.05 and dk = (n1 + n2 -2). From the calculation results obtained that t_{count} = 5.56 while t_{table} = 1.6671 at dk = 78. Thus $t_{count} > t_{table}$, so H_0 is rejected. This means that there are significant differences in student learning outcomes by applying discovery learning using concept maps and computer animation on hydrocarbon material.

This research uses discovery learning which can make students better to understand about hydrocarbons. During the learning process where students get a stimulus to be able to focus more and make it easier to understand the material provided, with the help of media that makes students easy to understand about hydrocarbons.

The hypothesis testing shows that student learning outcomes with discovery learning models using computer animation are higher than learning outcomes taught with discovery learning models using concept maps media on hydrocarbon material. Based on the results obtained, it can be said that the use of learning models with computer animation to increase student learning outcomes is quite good because it can improve learning outcomes.

D. CONCLUSION AND SUGGESTIONS

Based on the results of research conducted, several conclusions have been drawn: Student learning outcomes taught by applying discovery learning using concept maps and computer animation there are significant differences. This can be seen from the results of t-test analysis obtained tcount> ttable (5.56 <1.6671) at a significant level α = 0.05.

Based on the normalized gain data, the magnitude of the increase in student learning outcomes with discovery learning learning models using computer animation is 70% and the increase in learning outcomes using concept maps is 54%. The magnitude of the difference in the increase in student learning outcomes is 16%.

Based on the conclusions from the results of the study, the authors suggest the following: It is expected that prospective educators who want to apply discovery learning models with computer animation can use the time in accordance with what was planned in the learning implementation plan; It is expected that educators learn technology in the use of learning media in the learning process; and To other researchers who will examine this research with different subjects this can be used as a comparative study in improving the quality of education, especially at chemistry subjects.

REFERENCES

Boujaoude, S., & Attieh, M. (2008). The effect of using concept maps as study tools on achievement in chemistry. *Eurasia Journal of Mathematics, Science and Technology Education*, *4*(3), 233–246. https://doi.org/10.12973/ejmste/75345

Catur Saputro, A. N., Istiana, G., & Sukardjo, J. (2015). Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Aktivitas Dan Prestasi Belajar Pokok Bahasan Larutan Penyangga Pada Siswa Kelas Xi Ipa Semester Ii Sma Negeri 1 Ngemplak Tahun Pelajaran 2013/2014. *Jurnal Pendidikan Kimia Universitas Sebelas Maret*, *4*(2), 65–73.

Catur Saputro, A. N., Puspitasari, N., & Ashadi, A. (2015). Studi Komparasi Penggunaan Media

Animasi Dan Media Lks Dalam Pembelajaran Kooperatif Metode Teams Games Tournament (Tgt) Pada Materi Pokok Sistem Koloid Kelas Xi Ipa Sman 1 Sukoharjo Tahun Pelajaran 2013/2014. *Jurnal Pendidikan Kimia*, *4*(2), 8–14.

Fitriani, A., Danial, M., & Wijaya, M. (2014). Pengaruh Penggunaan Media Animasi pada Model Discovery Learning terhadap Hasil Belajar Kimia Peserta Didik Kelas X MIA SMAN 1 Bungoro (Studi pada Materi Pokok Ikatan Kimia). *Chemica*, *15*(2), 114–122.

Hatika, R. G. (2016). Peningkatan Hasil Belajar Fisika Dengan Menerapkan Model Pembelajaran Advance Organizer Berbantu Animasi Komputer. *Jurnal Pendidikan Fisika Indonesia*, *12*(2), 13–117. https://doi.org/10.15294/jpfi.v12i2.5210

Ismail, M., Lukman, & Alio, L. (2013). Meningkatkan hasil belajar ikatan kimia dengan menerapkan strategi pembelajaran peta konsep pada siswa kelas X di SMA Negeri I Telaga. *Jurnal Entropi*, *8*(1), 1–10.

Kurnianto, H., Masykuri, M., & Yamtinah, S. (2015). Pengaruh Model Pembelajaran Discovery Learning Disertai Lembar Kegiatan Siswa (Lks) Terhadap Prestasi Belajar Siswa Pada Materi Hidrolisis Garam Kelas Xi Sma Negeri 1 Karanganyar Tahun Pelajaran 2014/2015. *Jurnal Pendidikan Kimia Universitas Sebelas Maret*, *5*(1), 32–40.

Miller, K. J., Koury, K. A., Fitzgerald, G. E., Hollingsead, C., Mitchem, K. J., Tsai, H.-H., & Meeaeng Ko Park. (2009). Concept Mapping as a Research Tool to Evaluate Conceptual Change Related to Instructional Methods. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, *32*(4), 365–378. https://doi.org/10.1177/0888406409346149

Nbina, J. B., & Obomanu, B. J. (2010). The meaning of scientific literacy: A model of relevance in science education. *Academic Leadership*, *8*(4).

Oktarini, D., Jamaluddin, J., & Bachtiar, I. (2014). Efektivitas Media Animasi Terhadap Hasil Belajar Biologi Siswa Smpn 2 Kediri. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *2*(1), 1. https://doi.org/10.33394/j-ps.v2i1.1048

Putrayasa, I. M., Syahruddin, H., & Mergunayasa, I. G. (2014). Pengaruh Model Pembelajaran Discovery Learning Dan Minat Belajar Terhadap Hasil Belajar Ipa Siswa. *Jurnal Mimbar PGSD Universitas Pendidikan Ganesha*, *2*(1), 1–11. https://doi.org/10.1093/brain/awt103

Saputra, W., & Nofita, I. (2018). *Pengaruh Model Discovery Learning Berbantuan Media Animasi Macromedia Flash terhadap Aktivitas Siswa pada Materi Tekanan di SMP Negeri 1 Suhaid*. *1*(1), 17–21.

Setiyawan, D., & Indrowati, M. (2014). *the Comparison Between Discovery Learning With Concept Map and Discovery Learning To Understanding Concept Protista of X Grade Students Sma Negeri*. *5*(April).

Swaak, J., De Jong, T., & Van Joolingen, W. R. (2004). The effects of discovery learning and expository instruction on the acquisition of definitional and intuitive knowledge. *Journal of Computer Assisted Learning*, *20*(4), 225–234. https://doi.org/10.1111/j.1365-2729.2004.00092.x

Tumurun, S. W., Gusrayani, D., & Jayadinata, A. K. (2016). Pengaruh Model Pembelajaran Discovery Learning Terhadap Keterampilan Berpikir Kreatif Siswa Pada Materi Sifat-Sifat Cahaya. *Pengaruh Model Pembelajaran Discovery Learning Terhadap Keterampilan Berpikir Kreatif Siswa Pada Materi Sifat-Sifat Cahaya*, *1*(1), 101–110. https://doi.org/10.23819/pi.v1i1.2936