Artikel

by Andang Sunarto

Khairiah, Imam Tabroni, Delfia Herwanis, Anik Indramawan, Suhartono, Yeni Tri Nurrahmawati. (2022). A Comparison Study: The Effect of Flipped Classroom vs Direct Instruction Model Toward Science Concepts Understanding. *International Journal of Early Childhood Special Education (INT-JECSE),* 14(1): 530-536. DOI: 10.9756/INT-JECSE/V14I1.221065

Received: 30.09.2021 Accepted: 16.12.2021

Khairiah[1]
Imam Tabroni[2]
Delfia Herwanis[3]
Anik Indramawan[4]
Suhartono[5]
Yeni Tri Nurrahmawati[6]

A Comparison Study: The Effect of Flipped Classroom vs Direct Instruction Model Toward Science Concepts Understanding

Abstract

The purpose of this study was to examine the comparison between the flipped classroom model and the direct instruction model on students' understanding of scientific concepts. The type of research used is quasy experiment. This research was conducted in class VIII Islamic Junior High School Al-Karim Gondang (experimental class) and Islamic Junior High Darul 'ulum Gondang Nganjuk Indonesia (control class). Sampling was using cluster random sampling technique and hypothesis testing using SPPS application with one way ANOVA test. The results showed that there were differences in the effect of the flipped classroom model and the direct instruction model on students' understanding of science concepts, where the significance value was 0.000 < 0.05 The flipped classroom model has a better effect than the direct instruction model on students' understanding of scientific concepts. The average score of the students' science concept understanding test scores in the class that was taught using the flipped classroom model was 78.13 and the class taught by the direct instruction model was 71.43. The flipped classroom model is effective for science learning and improves students' understanding of scientific concepts.

Keywords: Flipped Classroom Model, Direct Instruction Model, Concept Understanding, Science.

Introduction

Understanding is an important factor in learning activities (Santrock, 2010) and an absolute requirement for achieving learning success (Eraikhuemen & Ogumogu, 2014) . One of the learning objectives is to help students understand concepts, not just remember separate facts (Santrock, 2010). Concept understanding is defined as a student's ability to build a relationship between new and previous knowledge (Hailikari, Katajavuori, & Lindblom-Ylanne, 2008) understand and interpret objects and events, as well as the relationship between the two with the students' own language.

Understanding the concept becomes the foundation for students to build insight and wisdom solve problems (Holme, Luxford, &

Khairiah[1], State Iinstitute for Islamic Studies of Bengkulu, Indonesia.
Email: khairiah@iainbengkulu.ac.id
Imam Tabroni[2], STAI Dr. KH. EZ. Mutttaqien Purwakarta.
E-mail: imamtabroni70@gmail.com
Delfia Herwanis[3], IAIN Takengon. E-mail: delfiaherwanis3@gmail.com
Anik Indramawan[4], Institut Agama Islam Pangeran Diponegoro Nganjuk.
Email: anikindramawana12345@gmail.com
Suhartono[5], Institut Agama Islam Pangeran Diponegoro Nganjuk.
Email: suhartono@iaipd-nganjuk.ac.id
Yeni Tri Nurrahmawati[6], STAI AT Taqwa Bondowoso. Email: yeni.genbie04@gmail.com

Brandriet, 2015) and minimize student misconceptions (Eraikhuemen & Ogumogu, 2014). Students are considered to understand the concept, if they can capture learning messages, so that they are able to apply concepts to solve problems in everyday life (Anderson & Krathwohl, 2001; 2010; O'Dwyer, Wang, & Shields, 2015) and if students do not understand a concept, then students have difficulty choosing ways to solve the problems they face. Indicators of understanding of the revised Bloom's taxonomy learning outcomes include the ability to interpret, provide examples, classify, summarize, conclude, compare, and explain (Anderson & Krathwohl, 2001; 2010).

Science has a very big role in preparing superior human resources, training to develop systematic, logical and critical thinking skills, and training students to make discoveries and engineering with scientific work steps. Understanding the concept of science is an important provision for students to solve science problems (Mehmet, 2010) so that they are able to adapt to social life (Archer-Bradshaw, 2014) and be able to compete in the era of globalization (Turiman, Omar, Daud, & Osman, 2012). *Organisation for Economic Cooperation and Development* (OECD) (2007) states that understanding the concept of science is an important weapon for students to achieve the expected goals.

Students' understanding of science concepts is still a serious problem. Students often experience misconceptions (Arslan, Cigdemoglu, & Moseley, 2012) which affect student achievement (Arslan, Cigdemoglu, & Moseley, 2012) and students' low understanding of science concepts. In addition, students' low understanding of science concepts is influenced by learning activities that have not been carried out optimally, students are less motivated to think activities, students only listen to teachers and do not really understand the concept of learning. Several research results state that the learning process is still a lot on efforts to develop students' memory/memorization (Tan & Halili, 2015), centered on teachers, and the application of learning models that are not suitable for learning topics (Wittmann & Chase, 2012), which tend to be lectures an important step for effective learning by involving students actively in the learning process (Yakar & Baykara, 2014). One of the steps that can be taken is changing the conventional learning model with the flipped classroom model.

Flipped Classroom means inverted class (Strayer, 2012), where conventional activities carried out in class become activities at home, and activities carried out at home such as homework become activities carried out in class (Bergmann & Sams, 2012; Ozdamli & Asiksoy, 2016; Suhartono, et.al., 2021). The flipped classroom model is a student-centered learning model (Bergmann & Sams, 2012; Midun, Degeng, Kuswandi, & Ulfa, 2019) and fosters active learning (Ozdamli & Asiksoy, 2016), so that students do not become passive listeners, but are more active in learning.

The direct instruction model is the most common learning model and is often used by teachers in the learning process. This model is specifically designed to support the learning process related to declarative and procedural knowledge step by step. The direct instruction model is more teacher centered (Kousar & Shah, 2010) by emphasizing the delivery of material verbally from teachers to students (Nasution, 2017) regarding new concepts or skills and teacher involvement in collaboration with students individually or in small groups (Watanabe, McLaughlin, Weber, & Shank, 2013). The direct instruction model can be used in an effort to achieve learning objectives at the level of conceptual understanding (Reigeluth & Carr-Cheliman, 2009).

The learning model has advantages and disadvantages. All learning models are none better and none worse. Likewise, the flipped classroom model and the direct instruction model have similarities and differences. stated that the learning models related to 21st century skills-based learning are meaningful learning, active learning, direct learning, indirect learning, and distance learning. The difference between the flipped classroom model and the direct instruction model is that the flipped classroom model is based on constructivist learning theory, in which students build their own knowledge individually and collectively (Bada, 2015; Dagar & Yadav, 2016). Meanwhile, Engelmann (Kousar & Shah, 2010) states that the direct instruction model is based on behavioristic learning theory. Choosing the right learning model by the teacher will affect students' better understanding of concepts.

Referring to theoretical and empirical exposures, students' learning models and conceptual understanding have an influence on student learning outcomes. The use of appropriate learning models and good student understanding of a concept will result in good student learning outcomes. The application of the flipped classroom model or the direct instruction model can certainly change students' cognitive, affective, and psychomotor learning outcomes. Likewise, students' understanding of concepts can provide experience in solving problems and achieving learning achievement. Teachers must innovate in applying learning models to achieve the specified learning objectives.

Research Methods

This study used a quasy experimental research type (quasy experimental research). The research design used was posttest only control group design. This design involves two classes, namely the experimental group and the control group.

The population in this study were all students of class VIII at Madrasah Tsanawiyah in Gondang Nganjuk Indonesia, namely MTs Al-Karim totaling 30 students, MTs. Al-Huda totaling 26 students, and Islamic Junior High School. Darul 'Ulum totaling 30 students. Sampling with cluster random sampling technique. The research subjects were students of class VIII MTs Al-Karim Gondang Nganjuk Indonesia as an experimental class that was taught using the flipped classroom model and grade VIII students of MTs. Darul 'Ulum Gondang Nganjuk Indonesia as a control class that is taught using a direct instruction model.

The variables in this study include (1) independent variables, consisting of (a) the flipped classroom model is applied to the experimental class marked "FC" and (b) the Direct Instruction model applied to the control class marked with "DI" and (2) the dependent variable is students' understanding of science concepts.

The data collection technique used in this study was a scientific concept understanding test technique. The research instrument used was a science concept understanding test sheet. The conceptual understanding test in this study was in the form of an essay test totaling 10 items, but there were 7 valid test items and 3 invalid items. This comprehension test is structured based on indicators of cognitive learning outcomes in the comprehension dimension (C2) with operational verbs in Bloom's revised taxonomy (Anderson & Krathwohl, 2001; 2010), including (1) interpreting, (2) exemplifying, (3) classifying, (4) summarizing, (5) concluding, (6) comparing, and (7) explaining. The scoring of each item refers to the rubric of assessing concept understanding by Abraham, Williamson, & Westbrook (1994) which consists of (1) a score of 4 for correct answers and containing all scientific concepts, (2) a score of 3 for correct answers and contains at least one scientific concept and does not contain misconceptions, (3) a score of 2 for the answer provides partially correct information but also shows a misconception in the explanation, (4) a score of 1 for an answer that indicates a fundamental error about the concept being studied, and (5) a score of 0 for wrong, irrelevant, repeated questions, or blank answers.

Data analysis used analysis prerequisite test and hypothesis test. Normality and homogeneity test to determine the normal distribution and homogeneity of the sample. In the test using a significance level of 0.05 with a significance value greater than α (Sig. > 0.05). Hypothesis testing aims to determine the effect of the flipped classroom (FC) model on understanding scientific concepts. Hypothesis testing using one way ANOVA test assisted by SPSS with a significance value smaller than α (Sig <0.05).

Results and Discussion

This study aims to examine the difference in the effect of the flipped classroom model with the direct instruction model on the understanding of science concepts in class VIII students at MTs Al-Karim Gondang and MTs. Darul 'Ulum Gondang Nganjuk Indonesia. After testing the reliability and validity of the test instrument for understanding the concept of science, it shows (1) reliable and (2) valid, then the prerequisite test is the normality and homogeneity test.

The normality test of students' understanding of science concepts in the two treatment classes can be seen in the following table:

Table 1.

Normality Test of Test Score Results Students' Understanding of Science Concepts

Tests of Normality				
	Class	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Understanding of Science concept	FC	.123	30	.200*
	DI	.137	30	.160
*. This is a lower bound of the true significance.				
a. Lilliefors Significance Correction				

Based on table 1, the significance value in the two treatment classes shows more than the α significance level of 0.05 (Sig.> 0.05). In the experimental class that was taught using the flipped classroom (FC) model it was 0.200 and the control class taught using the direct instruction (DI) model was 0.160, meaning that the test scores were normally distributed.

The homogeneity test of students' understanding of science concepts from the two treatment classes can be seen in the following table.

Table 2.

Homogeneity Test Students' Understanding of Science Concepts

Test of Homogeneity of Variances			
Understanding of Science Concepts			
Levene Statistic	df1	df2	Sig.
1.364	1	58	.248

Table 2 The results of the homogeneity test can be seen that the significance value is 0.248, meaning that the significance value obtained is more than 0.05 (Sig. ≥ 0.05), so the score data from the two classes have the same variance (homogeneous).

After the two prerequisite tests above were carried out, it was followed by a hypothesis test with the one-way ANOVA test, the results were as follows:

Table 3.

Hypothesis Test Results Students' Understanding of Science Concepts

ANOVA					
Understanding of Science Concepts					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	673.350	1	673.350	18.226	.000
Within Groups	2142.833	58	36.945		
Total	2816.183	59			

The results of hypothesis testing in table 3 show the sig value. smaller than the significance level of 0.05 (sig <0.05), namely the sig value. is .000 less than 0.05 (0.000 <0.05), which means that there is a difference in the effect between the two learning models used on students' understanding of science concepts. The difference in the effect of the two learning models used on students 'understanding of science concepts, can be seen from the average score of students' understanding of science concepts from the two learning models, as shown in the following table:

Table 4.

Students' Score of Science Concept Understanding

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
FC	30	68	90	78.13	6.388
DI	30	58	79	71.43	5.752
Valid N (listwise)	30				

The average score of students' understanding of science concepts in the two treatment classes based on the indicator of understanding can be seen in the following table:

Table 5.

Average Score of Students' Science Concept Understanding based on Understanding Indicators in Revised Bloom Taxonomy by Anderson & Krathwolh

Class	Mean							
	Interpreting	Exemplifying	Classifying	Summarizing	Concluding	Comparing	Explaining	Total
FC	76.13	80.37	80.37	80.63	79.40	73.33	77.90	78.13
DI	66.23	75.53	74.27	73.13	73.87	65.83	71.17	71.43

For more details, the average score of students' understanding of science concepts can be seen in the following histogram:

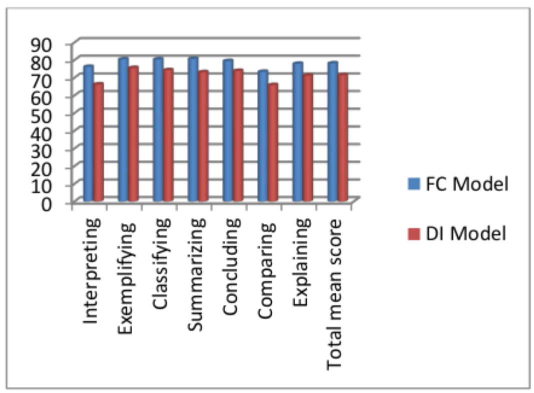

Figure 1.

The Histogram of Score Average Students' Science Concept Understanding based on the Indicators of Understanding in the Revised Bloom Taxonomy by Anderson & Krathwolh

Table 5 and Figure 1 of the histogram above, show the average score of students' understanding of science concepts based on indicators of understanding in the revised bloom taxonomy, there are differences between the classes that were taught using the flipped classroom (FC) model and the direct teaching model. Students' understanding of science concepts taught using the flipped classroom (FC) model with a total mean of 78.13 and those being taught using the direct teaching model was 71.43. The average score of students' understanding of science concepts taught using the flipped classroom (FC) model is better than those taught using the flipped classroom (FC) model.

The results of hypothesis testing show that the flipped classroom (FC) model is more effective than the direct instruction model for students' understanding of scientific concepts. The flipped classroom model is more effective due to the involvement of students in understanding concepts starting from learning outside the classroom (home) and inside the classroom. At home, students study subject matter and learning in class, students do assignments, discuss material that students have not understood. Research results by Davies, Dean, & Ball (2013); Gilboy, Heinerichs, & Pazzaglia (2015); mentioned the flipped classroom model as a learning model that involves students actively in learning activities.

The flipped classroom model is oriented towards student-centered learning (Bergmann & Sams, 2012; Bishop & Verleger, 2013; Midun, Degeng, Kuswandi, & Ulfa, 2019), students take control and are responsible for their own learning (Gilboy, Heinerichs, & Pazzaglia, 2015), making learning effective by actively involving students in the learning process (Suhartono, et.al., 2021). Research Results by Suhartono, Degeng, Suyitno, & Sulton (2019); states that the learning process will be effective if the learning process is student-centered, so that students actively participate in the learning process.

The application of the learning model between the flipped classroom model and the direct instruction model, there are differences in students' understanding of scientific concepts. The flipped classroom model is better for students' understanding of scientific concepts. Research results by Bansal, Bansal, Ahmad, & Pandey (2020) stated that the flipped classroom model has a significant effect on students' understanding of scientific concepts. In the flipped classroom model, students have a lot of time to study, not only in class but outside the classroom. Outside the classroom (at home) students study the material and do assignments, then in class problem solving is carried out by discussing and completing assignments/ evaluations given by the teacher (Suhartono, et.al., 2021). Outside the class, students can study the material repeatedly until they really understand the material discussed before entering class. In addition, students can explore learning material extensively that will be discussed and deepened in class, then the discussion and communication process in class with classmates can strengthen understanding and produce deeper learning and strengthen a concept. together (Christiansen, 2018).

The low learning outcomes of students' understanding of science concepts in classes taught by the direct instruction model are due to the fact that most of the learning is still dominated by teachers, where the learning process emphasizes giving concepts from teachers to students, so that students are only listeners and passive in learning activities (Reigeluth, 1999). This learning model tends to be only for students who have good cognitive abilities, but students who have low cognitive abilities tend to be passive in the learning process. The direct instruction model only emphasizes the delivery of learning material without paying attention to concepts related to students' daily lives. The learning process, such as the direct instruction model, is certainly less effective in developing learning achievement in students. This learning model focuses more on the aspects of remembering and has less understanding of the material being studied. The direct instruction model is very appropriate only for students who have good intellectual abilities, but students with low abilities need several repetitions to achieve certain competencies (Peterson, 2011).

The flipped classroom model provides a better effect on student learning outcomes. Research results by Balaban, Gilleskie, & Tran (2016); Wasserman, Quint, Norris, & Carr (2017); Thai, Phielix, Janssen, & Kester (2019) stated that students studying in the flipped classroom model achieve higher and significant learning outcomes than students in conventional model class. Research results by also stated that the flipped classroom model has a significant different effect from traditional models on cognitive learning outcomes. The flipped classroom model can be used as a learning model that can create active and effective student-centered learning and can improve cognitive learning outcomes including student understanding of concepts.

Conclusion

Based on the results of research and discussion, it can be concluded that there is a difference in the effect of the flipped classroom model and the direct instruction model on students' understanding of scientific concepts. This is evidenced from the results of hypothesis testing with the one way ANOVA test showing a significance value of $0.000 < 0.05$. The flipped classroom model has a better effect on students 'understanding of science concepts than the direct instruction model, indicated by the average score of students' science concept understanding test scores. Students' understanding of science concepts taught using the flipped classroom model obtained an average score of 78.13 and the direct instruction model obtained an average score of 71.43. The flipped classroom model can be an alternative learning model used to improve students' understanding of scientific concepts.

References

Abraham, M.R., Williamson, V.M., & Westbrook, S.L. (1994). A Cross Age Study of Understanding of Five Chemistry Concepts. *Journal of Research in Science Teaching, 31*(2), 147-165.

Archer-Bradshaw, R.E. (2014). Demystifying Scientific Literacy: Charting the Path for the 21st Century. *Journal of Educational and Social Research*, *4*(3), 165-172. https://doi.org/10.5901/jesr.2014.v4n3p165

Arends, R.I. (2012). *Learning to Teach 12th*. New York: The McGraw-Hill Companies Inc.

Arslan, H.O., Cigdemoglu, C., & Moseley, C. (2012). A Three-Tier Diagnostic Test to Assess Pre-Service Teachers' Misconceptions about Global Warming, Greenhouse Effect, Ozone Layer Depletion, and Acid Rain. *International Journal of Science Education, 34*(11), 1667–1686. https://doi.org/10.1080/09500693.2012.680618

Bada, S.O. (2015). Constructivism Learning Theory: A Paradigm for Teaching and Learning. *IOSR Journal of Research & Method in Education, 5*(6), 66-70.

Balaban, R.A., Gilleskie, D.B., & Tran, U. (2016). A quantitative evaluation of the fipped classroom in a large lecture principles of economics course. *The Journal of Economic Education*, *47*(4), 269–287.

Bansal, S., Minakshi Bansal, M., Ahmad, K.A., & Pandey, J. (2020). Effects of a flipped classroom approach on learning outcomes of higher and lower performing medical students: A new insight. *Advances in Educational Research and Evaluation*, *1*(1), 24-31.

Bergmann, J., & Sams, A. (2012). *Flip Your Classroom: Reach Every Student in Every Class Every Day*. United States: The International Society for Technology in Education.

Bishop, J.L., & Verleger, M.A. (2013). The flipped classroom: A survey of the research. I*n ASEE National Conference Proceedings, Atlanta, GA*, *30*(9), 1–18.

Christiansen, M.A. (2018). Inverted Teaching: Applying a New Pedagogy to a University Organic Chemistry Class. *Journal of Chemical Education*, *91*(11), 1845-1850.

Dagar, V., & Yadav, A. (2016). Constructivism: A Paradigm for Teaching and Learning. *Arts and Social Sciences Journal*, *7*(4), 1-4.

Davies, R.S., Dean, D.L., & Ball, N. (2013). Flipping The Classroom and Instructional Technology Integration in a College-Level Information Systems Spreadsheet Course. *Educational Technology Research and Development*, *61*(4), 1-21.

Eraikhuemen, L., & Ogumogu, A.E. (2014). An Assessment of Secondary School Physics Teachers Conceptual Understanding of Force and Motion in Edo South Senatorial District. *Academic Research International*, *5*(1), 253-262.

Gilboy, M.B., Heinerichs, S., & Pazzaglia, G. (2015). Enhancing Student Engagement Using the Flipped Classroom. *Journal of Nutrition Education and Behavior, 47*(1), 109–114.

Hailikari, T., Katajavuori, N., & Lindblom-Ylanne, S. (2008). The Relevance of Prior Knowledge in Learning and Instructional Design. *American Journal of Pharmaceutical Education*, *72*(5), 113- 120.

Holme, T.A., Luxford, C.J., & Brandriet, A. (2015). Defining Conceptual Understanding in General Chemistry. *Journal of Chemical Education, 92*(9), 1477-1483. https://doi.org/10.1021/acs.jchemed.5b00218

Jia, Q. (2010). A brief study on the implication of constructivism teaching theory on classroom teaching reform in basic education. *International Education Studies*, *3*(2), 197-199.

Kousar, R., & Shah, P.M.A. (2010). The Effect of Direct Instruction Model on Intermediate Class Achievement and Attitudes Toward English Grammar. *Journal of College Teaching & Learning*, *7*(2), 99-103.

Mehmet, S. (2010). Effects of Problem-Based Learning on University Students' Epistemological Beliefs about Physics and Physics Learning and Conceptual Understanding of Newtonian Mechanics. *Journal of Science Education and Technology*, *19*(3), 266-275.

Midun, H., Degeng, I.N.S., Kuswandi, D., & Ulfa, S. (2019). Effects of Inverted Classroom and Self-Regulated Learning on Conceptual Learning. *International Journal of Innovation, Creativity and Change, 8*(2), 181-201.

Nasution, W.N. (2017). The Effects of Learning Model and Achievement Motivation on Natural Science Learning Outcomes of Students at State Islamic Elementary Schools in Medan, Indonesia. *Journal of Education and Training*, *4*(2), 131-150. https://doi.org/10.5296/jet.v4i2.11144

O'Dwyer, L.M., Wang, Y., & Shields, K.A. (2015). Teaching for Conceptual Understanding. A Cross-national Comparison of the Relationship Between Teachers' Instruction Practices and Student Achievement in Mathematics. *Large-scale Assessments in Education*, *3*(1),1-30. https://doi.org/10.1186/s40536-014-0011-6

OECD. (2007). *PISA 2006 Science Competencies For Tomorrow's World, Volume 1*. Paris 2007.

Ozdamli, F., & Asikoy, G. (2016). Flipped Classroom Approach. *World Journal on Education Technology*, *8*(2), 98-105.

Peterson, P.E. (2011). Eighth-grade students learn more through direct instruction. *Education Next*, *11*(3), 7-8.

Reigeluth, C.M. (1999). What is Instructional Design Theory and How is it Changing? Dalam C.M. Reigeluth (Ed.). *Instructional Design Theory and Model,* Volume II (5-29). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Reigeluth, C.M., & Carr-Cheliman, A.A. (2009). Theories for Different Outcomes of Instruction. Dalam C.M. Reigeluth, & A.A. Carr-Cheliman (Eds.), *Instructional-Design Theories and Models: Building a Common Knowledge Base*, Volume III (195-197). Madison Ave, New York: Routledge Taylor and Francis Group.

Santrock, J.W. (2010). *Educational Psycology*. Dallas: McGraw-Hill Company, Inc.

Strayer, J.F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning environments research*, *15*(2), 171-193.

Suhartono, S., Degeng, I. N., Suyitno, I., & Sulton, S. (2019). A Comparison Study: Effects of the Group Investigation Model and Direct Instruction Model toward Science Concept Understanding. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 185-192. https://doi.org/10.15294/jpii.v8i2.18135.

Suhartono, S., Suherman, S., Novita Loma, S., Lourine Since, J., Rukhama, A., Yowelna, T., & Suheri, S. (2021). A Theoretical Study: The Flipped Classroom Model As An Effective And Meaningful Learning Model In Multiple Era. *Psychology*, *58*(1), 4811-4820.

Turiman, P., Omar, J., Daud, A.M., & Osman, K. (2012). Fostering the 21st Century Skills through Scientific Literacy and Science Process Skills. *Procedia - Social and Behavioral Sciences*, *59*, 110-116. https://doi.org/10.1016/j.sbspro.2012.09.253

Van Alten, D.C., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review*, *28*.

Wasserman, N.H., Quint, C., Norris, S.A., & Carr, T. (2017). Exploring fipped classroom instruction in calculus III. *International Journal of Science & Mathematics Education, 15*(3), 545–568.

Watanabe, M., McLaughlin, T.F., Weber, K.P., & Shank, L. (2013). The Effects of Using Direct Instruction to Teach Coin Counting and Giving. *International Journal of Basic and Applied Science*, *2*(1), 150-159.

Wittmann, M.C., & Chase, E. (2012). Evidence of embodied cognition about wave propagation. *In AIP Conference Proceedings*, *American Institute of Physics, 1413*(1), 383-386.

Yakar, Z., & Baykara, H. (2014). Inquiry-based laboratory practices in a science teacher training program. *Eurasia Journal of Mathematics, Science and Technology Education*, *10*(2), 173-183.

Artikel

ORIGINALITY REPORT

16%	10%	12%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Nur Islamiati, Dina Amalya Lapele, Beatrix Purnama Sari. "Mathematical Problem Solving Ability in terms of Mathematical Disposition on the Application of Group Investigation (GI) Learning Models", Edumatica : Jurnal Pendidikan Matematika, 2021 Publication	1%
2	www.formapex.com Internet Source	1%
3	Irfan Jaenudin, Pratiwi Nur Aisyiah, Rani Suryani, Ari Widodo. "Content analysis of the nature of science on elementary thematic textbooks 2013 curriculum", Premiere Educandum : Jurnal Pendidikan Dasar dan Pembelajaran, 2021 Publication	1%
4	repository.usfca.edu Internet Source	1%
5	www.erudit.org Internet Source	1%

6 David F. Treagust, A. L. Chandrasegaran. "The Taiwan National Science Concept Learning Study in an International Perspective", International Journal of Science Education, 2007
Publication
1 %

---

7 www.journal.ikipsiliwangi.ac.id
Internet Source
1 %

---

8 Bhakti Karyadi, I. Ansori, P. Aswin. "Understanding Skill of Junior High School Students on Environmental Pollution Topic by Environmental-based Science Learning", Journal of Physics: Conference Series, 2019
Publication
1 %

---

9 Micheal Moos van Wyk. "chapter 14 Flipping the Class for Students to Learn to Teach Economics", IGI Global, 2018
Publication
<1 %

---

10 Wawan Herry Setyawan, Agus Budiman, Dhiyan Septa Wihara, Triana Setyarini, Nurdyansyah, Robbi Rahim, Muh Barid Nizarudin Wajdi. "The effect of an android-based application on T-Mobile learning model to improve students’ listening competence", Journal of Physics: Conference Series, 2019
Publication
<1 %

11	Astunnisyah, Budiyono, Isnandar Slamet. "The comparison of learning model viewed from the student cognitive style", AIP Publishing, 2017 Publication	<1 %
12	Yinghui Shi, Yanqiong Ma, Jason MacLeod, Harrison Hao Yang. "College students' cognitive learning outcomes in flipped classroom instruction: a meta-analysis of the empirical literature", Journal of Computers in Education, 2019 Publication	<1 %
13	ejournal.poltekkes-smg.ac.id Internet Source	<1 %
14	gtg.webhost.uoradea.ro Internet Source	<1 %
15	Scales, Peter. "EBOOK: An Introduction to Learning and Teaching in Higher Education", EBOOK: An Introduction to Learning and Teaching in Higher Education, 2017 Publication	<1 %
16	Suazette R. Mooring, Chloe E. Mitchell, Nikita L. Burrows. "Evaluation of a Flipped, Large-Enrollment Organic Chemistry Course on Student Attitude and Achievement", Journal of Chemical Education, 2016 Publication	<1 %

17	educationaltechnologyjournal.springeropen.com Internet Source	<1 %
18	Riska Fitriani, Shella Maryani, Diki Chen, Febri Tia Aldila et al. "Mendeskripsikan Keterampilan Proses Sains Siswa melalui Kegiatan Praktikum Viskositas di SMAN 1 Muaro Jambi", PENDIPA Journal of Science Education, 2021 Publication	<1 %
19	aa-rf.org Internet Source	<1 %
20	www.ejpbl.org Internet Source	<1 %
21	www.slideshare.net Internet Source	<1 %
22	Baharuddin Adera Gebru. "Effect of Instructional Model and Learning Materials Towards Competency in Using and Regulating of Electrical Motor", Education Journal, 2015 Publication	<1 %
23	Parno, J Mufidah, M Diantoro. "Comparison of building understanding of students on newton’s laws with phenomenon-based ADI with assessment formative and ADI models", Journal of Physics: Conference Series, 2021 Publication	<1 %

24	Theresa Margaretta Sirait, Derlina. "The effect of problem based learning model towards physics learning outcomes at dynamic electricity course", 2015 International Conference on Technology, Informatics, Management, Engineering & Environment (TIME-E), 2015 Publication	<1 %
25	biarjournal.com Internet Source	<1 %
26	ir.lib.uwo.ca Internet Source	<1 %
27	journal.ia-education.com Internet Source	<1 %
28	journal.staihubbulwathan.id Internet Source	<1 %
29	scholarworks.umass.edu Internet Source	<1 %
30	"Active Learning in College Science", Springer Science and Business Media LLC, 2020 Publication	<1 %
31	Agung Mandiro Cahyono. "Metode Menabung Perspektif Zaman Nabi Yusuf As.", Journal of Sharia Economics, 2019 Publication	<1 %

32	Anne Katz, Tricia Muldoon Brown, Jackie Hee Young Kim. "chapter 7 A Professional Development Framework for the Flipped Classroom Model", IGI Global, 2016 Publication	<1 %
33	E Z Jamaan, D N Musnir, Z Syahrial. "The effect of problem-based learning model on students' geometry achievement by controlling mathematics initial ability", Journal of Physics: Conference Series, 2020 Publication	<1 %
34	Fikret Korur, Gizem Enil, Gizem Göçer. "Effects of two combined methods on the teaching of basic astronomy concepts", The Journal of Educational Research, 2015 Publication	<1 %
35	Indah Tri, Evi Suryawati, Eliwarti Eliwarti. "Video Lectures in Online EFL Flipped-Classroom: Effectiveness, Students' Evaluation and Experiences", European Journal of Educational Research, 2022 Publication	<1 %
36	Stefano Sandrone, Jimmy V. Berthaud, Chad Carlson, Jacquelyne Cios et al. "Education Research: Flipped classroom in neurology", Neurology, 2019 Publication	<1 %

37	d.researchbib.com Internet Source	<1 %
38	ejournal.unsri.ac.id Internet Source	<1 %
39	eprints.unm.ac.id Internet Source	<1 %
40	ojs.excelingtech.co.uk Internet Source	<1 %
41	refubium.fu-berlin.de Internet Source	<1 %
42	www.ajhssr.com Internet Source	<1 %
43	www.educacionyfp.gob.es Internet Source	<1 %
44	www.homeworkminutes.com Internet Source	<1 %
45	www.scirp.org Internet Source	<1 %
46	Erik Craft, Maia Linask. "Learning effects of the flipped classroom in a principles of microeconomics course", The Journal of Economic Education, 2019 Publication	<1 %

47	Hakan Polat, Songül Karabatak. "Effect of flipped classroom model on academic achievement, academic satisfaction and general belongingness", Learning Environments Research, 2021 Publication	<1 %
48	digitalcommons.csumb.edu Internet Source	<1 %
49	"Handbook on Digital Learning for K-12 Schools", Springer Science and Business Media LLC, 2017 Publication	<1 %
50	Mei‐Hung Chiu. "A National Survey of Students’ Conceptions of Chemistry in Taiwan", International Journal of Science Education, 2007 Publication	<1 %
51	Maija Ahtee. "Students' understanding of chemical reaction", International Journal of Science Education, 3/1998 Publication	<1 %

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		