Journal of Education and Learning Mathematics Research (JELMaR)

Online ISSN : 2715-9787
Print ISSN : 2715-8535
Journal Homepage : http://jelmar.wisnuwardhana.ac.id/index.php/jelmar/index

Developing Cognitive Conflict to Overcome Students' Thinking Difficulties

Sumadji & Timbul Yuwono

To cite this article: Yuwono, T., & Sumadji, S. (2020). Developing Cognitive Conflict to Overcome Students' Thinking Difficulties. *Journal of Education and Learning Mathematics Research (JELMaR)*, *1*(2), 104-113. https://doi.org/10.37303/jelmar.v1i2.38

To link this article : https://doi.org/10.37303/jelmar.v1i2.38

Publisher
Department of Mathematics Education,
Faculty of Teacher Training and Education,
Universitas Wisnuwardhana Malang

Journal of Education and Learning Mathematics Research (JELMaR)
Volume: 1, Number: 2, November 2020, pp. 104-113
p-ISSN: 2715-8535, e-ISSN: 2715-9787

Received: September 2020 *Revised: November 2020* *Accepted: November 2020* *Published: November 2020*

Developing Cognitive Conflict to Overcome Students' Thinking Difficulties

[1]*Sumadji, [2]Timbul Yuwono
[1,2,] Mathematics Educational Study Program, Universitas Kanjuruhan Malang
Email:*[2]*timbulyuwono@unikama.ac.id*

Abstract: *The purpose of this study is to describe the thinking difficulties of low-ability students. Low-ability students are those who can only reach score less than 66. The second objective is to know the effectiveness of cognitive conflict strategies in an effort to improve failed cognitive networks. The approach taken is qualitative with the type of classroom action research. In each action, it was applied the group learning strategy in the first session intended to explore additional thinking difficulties. In the second session their difficulties were overcome by implementing a cognitive conflict strategy. This research was completed in two actions based on the amount of material that consists of two parts. The research's conclusions describe the basic difficulties of students' thinking but are not summarized here. In this error, mostly students make their own formulas using distributive law on algebra. Another conclusion is that cognitive conflict strategies are effective at the level of 88.6% in overcoming thinking difficulties.*

Keywords: *Cognitive conflict, thinking difficulty*

INTRODUCTION

Based on the researchers' notes, the students' Trigonometry learning outcomes were not good enough. Meanwhile, the Trigonometry's material in the university level is only a little deeper than the material in school. It indicates that Trigonometry is relatively difficult for many learners as stated by Gür (2009) in which Trigonometry is one of the subjects that is difficult to understand.

In solving problems, some students often make mistakes, fall into the wrong perception. Generally, these mistakes are started from their school life. They learn in a cooperative, active and creative learning setting, but the guidance from the teacher is less intense. It can result in students misunderstanding of various things and at the end of the school life, mistakes have never been corrected. Most mistakes occured are they really believe the principles/formulas of their own making by applying algebraic axioms into Trigonometry. Beside that, they generally have low skills in solving problems.

Cognitive conflict can be defined as an imbalance that is created when newly acquired knowledge contradict to the existing knowledge (Moody, 2010). Cognitive conflict is identical with an imbalance in the process of assimilation-accommodation of knowledge. Students' difficulties in assimilating new knowledge into existing cognitive schemes can create imbalance and are indicated as conflicts (Shahbari & Peled, 2014). Lee & Kwon (2001) stated that cognitive conflict is a state of perception in which a student has a different opinion between what is in their cognitive structure and the environment or information they get, or between different components such as concepts, beliefs, substructures etc.

There are many studies on the thinking difficulty, but generally it is only limited to the classifications or the reasons why they do it without being given an alternative ways to overcome it. Therefore the authors want to know what the difficulties are like and want to see whether cognitive conflict strategies are effective in overcoming such difficulties.

There are many factors that cause difficulty in thinking, including teachers, methods, media, physics and others. The author will limit the students' mental activity process when they are solving problems during learning process. Thus it is assumed that their difficulty in thinking is not caused by supporting factors, learning models, media, students' physical disabilities and the like, but because of the conditions that exist in the students' minds.

Thinking is someone's mental activities in processing stimuli, data or information that are considered as problems to be solved. Thinking is a mental process, so it is difficult to see unless it is only the effects or signs during or after someone does it. Solving problems will get bad results if it is done without thinking.

According to Mason, et al. (2010) the mathematical thinking process has three phases; they are the 'enter' phase, the 'complete' phase and the 'review' phase. In the 'finishing' phase, it required all mathematical activities (techniques, principles and concepts) to be carried out. According to Davidson and Sternberg (2003) intellectual abilities, creativity, memory, and skills are also required in the 'finishing' phase.

Mathematical thinking process requires more power and it is not enough to memorize it only as an effort to possess facts or agreements. Abstract material will encourage a person to be free from the surrounding reality and demands to do it cognitively and logically in its conclusion. At this stage, one must compare concepts and then interpret phenomena or abstract it.

Thinking difficulties (learning difficulties) are chaotic conditions in the mind that result in failed conclusions when individuals are solving problems. Thinking difficulties are characterized by errors in disclosing the content in the mind. According to Hamalik (2010), thinking difficulties are things that result in failure or at least make a disturbance in learning progress. The existence of mistakes made when solving problems show that students are not successful in learning. If the error occurs when the students complete the test questions, the difficulty in thinking is indicated by the low score.

Based on Clement (2010) errors are grouped into 1) reading error, 2) reading comprehension difficulty, 3) transform error, 4) weakness in process skill, 5) encoding error, and 6) careless error.

Often in the learning process not all students can understand all the material. Students often have thinking difficulty when the learning process takes place. The situation that confuses their minds will continue if it is not known by others, such as friends or the teachers.

Wyrasti (2018) said that students who experience construction analogy errors and experience anomalous situations will have a problem-solving process in managing the anomalous situation and then fixing construction analogy errors and finally successfully solving the problem. Construction errors cannot be ignored. If this construction error is left unchecked, it will have serious implications for students, which means that it can spoil the next construction process or prevent students from solving problems. In this situation, intervention is needed when students cannot solve problems caused by construction errors (Djasuli et al, 2017).

In a condition of cognitive conflict, there is a knowledge imbalance of learners with information or learning resources. Learners use their cognitive abilities to find justification, confirmation or verification of their opinions. Wrong cognitive abilities can be corrected if learners continue to confirm (respond appropriately) from teachers or more capable friends. Learning that builds cognitive imbalance, that is the conflict between the initial cognitive structures and learning resources is called cognitive conflict strategies. Parwati

(2008) stated that the application of cognitive conflict strategies should not strengthen the misconceptions stability, but must be able to destabilize them.

The result of Ramlan's (2014) research was that the application of cognitive conflict strategies can develop critical thinking skills. The result of Wiranata et al. (2011) showed that the increase in understanding cognitive conflict strategies was significantly higher than the conventional strategies. Several other studies have produced similar conclusions. These studies do not describe students' difficulties. The difficulties are only classified based on certain theories, so that readers get less optimal experience and will make it difficult for teachers to overcome learning difficulties. The results of research by Nusantara et al (2019) showed that there were two characteristics of students' cognitive conflicts in solving problems; they are error - cognitive conflict - balance - problem solving and errors - cognitive conflict - balance - cannot solve the problem. Based on this gap, the researcher adopts cognitive conflict strategies to overcome thinking difficulties and at the same time describes them.

METHOD

This study is conducted using Qualitative approach. The type of the research is classroom action research, because the research aims to improve students' comprehension and teachers' performance. Related on it, Wiriaatmadja (2005) explained that classroom action reseach is how a group of teachers organizes their teaching practice condition, learning from own experience, and trying to improve the learning practice to see the real impact of these efforts.

This research was conducted at Kanjuruhan University Malang. The authors observed cases occured in low-ability students in Trigonometry courses. The research was carried out by the lecturer itself assisted by a member lecturer and 2 senior students.

The first stage wanted to find out if there were students who have thinking difficulty in Trigonometry courses. Thinking difficulty occured when a student got C+ as the highest score on the initial test 1 (T1) or the initial test 3 (T3). It was also possible that students who had a grade of at least B- have thinking difficulty, but the error was considered insignificant. The research was designed as shown in Table 1.

Table 1: The Schedule of KK Strategy Implementation

Number of Meeting						
1	2	3 - 7	8	9	10 – 14	15
-	T1	BK & KK	T2	T3	BK & KK	T4

BK: The implementation of Group Learning strategy **T1, T3: Initial Test**

KK: The implementation of Cognitif Conflict strategy **T2, T4: Final Test**

The activities conducted by the lecturer and students were observed by the member lecturer and 2 senior students. Thinking difficulties represented in the items of the T1 and T3 tests were arranged empirically before the study. The items on the T2 and T4 tests were added due to new difficulties arising from presentation in group learning. From the results of the T2 and T4 tests, it can also be seen the effectiveness of the application of cognitive conflict strategies in overcoming students' thinking difficulties. Mulyasa (2002) stated that the learning process was successful if at least 75% of students were actively involved physically, mentally and socially in learning. Learning was said to be successful if the observation score was at least 75%. The application of cognitive conflict strategies was said to be effective if at least 80% of students got B- as the final score.

The Result of the Study

In the pre-action stage, the lecturer gave a 90-minute initial test T1 at the second meeting. Test scores below B- were used as base data. From the test results, it was found that 14 students had thinking difficulty.

In the implementation of the first session, each meeting was carried out by students in a group learning strategy using presentation, discussion and practice methods for 75 minutes. In the second session, learning was carried out by the lecturer using cognitive conflict strategies for 75 minutes. Techniques for implementing cognitive conflict strategies were not fully presented here, only generally done by mostly providing resistance (counter) to students' wrong answers. The core material (problems), difficulties (student answers) and some cognitive conflicts are presented in Table 2.

Table 2: Problem, Answer and Cognitif Conflict of Action 1

No.	Problem	Student Answer	Cognitive Conflict
1	Where is angle A if $\tan A = \frac{3}{5}$?	In the quadrant III.	positive value. Thus, the angle A lies in quadrant I or III.
2	What is the value $\sin 105^0 - \sin 15^0$?	$\sin 105^0 - \sin 15^0 =$ $\sin(105-15)^0$ $= \sin 90^0 = 1$	In line with you, don't you $\frac{1}{2} = \sin 30^0 = \sin(90^0 - 60^0) =$ $\sin 90^0 - \sin 60^0 = 1 - \frac{1}{2}\sqrt{3}$ wrong. Pay attention $\sin 105^0 - \sin 15^0 =$ $2\cos\frac{1}{2}(105^0 + 15^0)\sin\frac{1}{2}(105^0 - 15^0)$ $= 2\cos 60^0 \sin 45^0 = \frac{1}{2}\sqrt{2}$
3	Jika $\sin A = \frac{3}{5}$. What is the value $\sin 2A$?	$\sin 2A = \frac{6}{5}$	So $\cos A = \frac{4}{5}$. because $\sin 2A = 2\sin A \cos A$, then $\sin 2A = 2 \cdot \frac{3}{5} \cdot \frac{4}{5} = \frac{24}{25}$
4	What is the value $\cos 120^0$?	$\cos 120^0 =$ $\cos(180-120)^0$ $= \cos 60^0 = \frac{1}{2}$.	120^0 is located in quadrant two and the value $\cos 120^0$ is negative so, $\cos 120^0$ $= -\cos 60^0 = -\frac{1}{2}$.
5	How many radians 135o?	$135^0 = \frac{135^0}{360^0} = \frac{3}{8}$ radian.	$135^0 = \frac{135^0}{360^0} \times 2\pi\, rad$ $= \frac{3}{8} \times 2\pi\, rad = \frac{3}{4}\pi$ radian.
6	Change $\cos 228^0$ be the acute angle trigonometric function!	$\cos 228^0$ $= \cos(228-180)^0$ $= \cos 48^0$	228^0 located in quadrant III. Value $\cos 228^0$ is negative. Jadi, $\cos 228^0$ $= -\cos(228-180)^0 = -\cos 48^0$.
7	suppose $\tan B = \frac{2}{3}$. $\sin B + \cos B = ?$	$\sin B = 2$, $\cos B = 3$ $\sin B + \cos B = 5$	The length of the slanted side, $\sqrt{2^2 + 3^2} = \sqrt{13}$.

			$\sin B = {}^{2}/_{\sqrt{13}}$, $\cos B = {}^{3}/_{\sqrt{13}}$. Jumlahnya ${}^{5}/_{\sqrt{13}}$
8	if $\tan a = 2$ and $\tan b = 3$, so how many $\tan(a+b)$?	$\tan(a+b) = \tan a + \tan b = 2+3 = 5.$	$\tan(a+b) = \dfrac{\tan a + \tan b}{1 - \tan a \cdot \tan b}$ $= \dfrac{2+3}{1-2\cdot 3} = {}^{5}/_{-5} = -1.$

Based on the observation sheet, the mean score of the learning process extracted from teachers' and students' activities was 92. Based on the T2 test results, out of 14 people who had thinking difficulty, only 7.1% still had thinking difficulty. This means that 92.9% of low-ability students have successfully completed it. The lesson will continue to discuss the second material in Action II while giving a 10-minute break in the middle of the process to improve a rather saturated lecture situation.

Before Action II was started, the lecturer gave initial test T3. The test duration was 90 minutes and conducted at the 9th meeting. The result of the test showed that 19 students' score were below B- (B minus) and later used as initial data.

In the first session, the learning activity was conducted by students using presentation, discussion and problem solving exercises method (all done by students without the help of lecturers) for 70 minutes. From this session, several new misconceptions will emerge beside those that emerged when doing the initial test. After resting in the classroom for 10 minutes, then the second session was continued. Learning is carried out by lecturers using cognitive conflict strategies (70 minutes) discussing core materials that contain students' thinking difficulties as shown in Table 3.

Table 3: Problem, Answer dan Cognitive Conflict of Action 2

No.	Problem	Student Answer	Cognitive Conflict
1	suppose $\sin 21^0 = p.$ How many $\sin 42^0$?	$\sin 42^0 = 2p$	We know that $\sin 45^0 = {}^{1}/_{2}\sqrt{2}.$ Is it true $\sin 90^0 = 2\cdot \sin 45^0 = 2\cdot {}^{1}/_{2}\sqrt{2} = \sqrt{2}$? even though $\sin 90^0 = 1.$
2	suppose $\cos 84^0 = p.$ Berapa $\cos 42^0$?	$\cos 42^0 = {}^{1}/_{2}\, p$	You answered $\cos 84^0 = 2\cdot \cos 42^0$; should be $\cos 84^0 = \cos(2\cdot 42)^0$. Pay attention, $\cos {}^{A}/_{2} = \pm\sqrt{\frac{1+\cos A}{2}}$. if $\cos 84^0 = p$, so $\cos 42^0 = \pm\sqrt{\frac{1+p}{2}}$.
3	Count $\dfrac{\cos 36^0 \cos 54^0}{\cos 18^0}$?	$\dfrac{\cos 36^0 \cos 54^0}{\cos 18^0}$ $= \dfrac{\cos 18^0}{\cos 18^0}\cdot(2\cdot 3) = 6.$	You consider $\cos 36^0 = 2\cos 18^0$. In line with your opinion, whether in line with your opinion, what $\cos 90^0 = 2\cos 45^0 \leftrightarrow 0 = \sqrt{2}$ right? The correct answer is $\dfrac{\cos 36^0 \cos 54^0}{\cos 18^0} = \dfrac{{}^{1}/_{2}(\cos 90^0 + \cos(-18^0))}{\cos 18^0} = {}^{1}/_{2}$

4	Finish $\cos 2x^0 = \frac{1}{2}\sqrt{2}$, $0 \le x \le 360^0$.	Students answered $2x = 45^0 \rightarrow x = 22\frac{1}{2}^0$.	Your answer is correct, but isn't it $\cos 2(157\frac{1}{2})^0 = \cos 315^0 = \frac{1}{2}\sqrt{2}$ also right? Note, the following are true: $2x = 45^0 + k \cdot 360^0 \rightarrow x = 22\frac{1}{2}^0 + k \cdot 180^0$. or $2x = -45^0 + k \cdot 360^0 \rightarrow x = -22\frac{1}{2}^0 + k \cdot 180^0$. Maka $x = 157\frac{1}{2}^0, 337\frac{1}{2}^0$
5	Finish $\tan x = \tan \pi/3$ dengan $0 \le x \le 2\pi$.	Students answered $x = \frac{1}{3}\pi$.	Your answer is correct, but it should be if $\tan x = \tan \frac{1}{3}\pi$, maka $x = \frac{1}{3}\pi + k \cdot \pi$. Jadi, $x = \frac{1}{3}\pi, \frac{4}{3}\pi$.
6	What is the minimum value of $2\sin x + \cos x$?	Students answered that the minimum score is $2(-1) + (-1) = -3$.	When sin x reaches a minimum (-1), then cos x is not -1, and vice versa. The value for sin x and cos x cannot be replaced by the value -1 at the same time. The correct answer is not shown here).
7	Finish $2\cos^2 x - \cos x = 0$ dengan $0^0 \le x \le 360^0$.	Students answered $2\cos^2 x = \cos x \rightarrow \cos x = \frac{1}{2}$. so, $x = 60^0$.	for $x = 90^0$, suitable. Pay attention, $2\cos^2 x - \cos x = 0 \rightarrow \cos x(2\cos x - 1) = 0$ $\rightarrow (1)\cos x = 0 \vee (2)\cos x = \frac{1}{2}$. so that, $x = 90^0 + k \cdot 360^0$ or $x = 270^0 + k \cdot 360^0 \rightarrow x = 90^0, 270^0$ so, $x = 60^0 + k \cdot 360^0$ or $x = 300^0 + k \cdot 360^0 \rightarrow x = 60^0, 300^0$ so, $x = 60^0, 90^0, 270^0, 360^0$.
8	What is the minimum value of $\sin x - \sqrt{3}\cos x$, $0^0 \le x \le 360^0$.	Students answered $(-1) - \sqrt{3}(-1) = \sqrt{3} - 1$	Note that when it reaches a maximum of -1, cos x is not -1, and vice versa. Thus, sin x and cos x cannot be replaced by 1 at the same time (correct answer not shown here).
9	Finish $\tan^2 x - 3 = 0$, $0^0 \le x \le 360^0$.	Students answered $\tan^2 x = 3 \rightarrow \tan x = \sqrt{3}$ $x = 60^0$ atau $x = 240^0$	Is $x = 120^0, 300^0$ not a solution? $(\tan 120^0)^2 - 3 = (-\sqrt{3})^2 - 3 = 0$? as well $(\tan 300^0)^2 - 3 = (-\sqrt{3})^2 - 3 = 0$?
10	Finish $\cos x^0 < \frac{1}{2}$ untuk $0 \le x \le 180$.	Students answered $\cos x^0 < \frac{1}{2} \rightarrow$ $\cos x^0 < \cos 60^0 \rightarrow x < 60$.	Is $x = 30$ solution? In line with you, $\cos 30^0 = \frac{1}{2}\sqrt{3} < \frac{1}{2}$. Is it wrong! If $\cos x^0 < \frac{1}{2}$, maka $60 < x \le 300$. it is recommended to look at the graph of the cosine function. (The correct answer is not shown).

This section describes the results of the research in a clear and detailed manner. The results of the research can be presented based on the results of the research at each stage of the research or the results of research that answer each problem formulation or others as long as it is clear results of the research that have been done that are clearly visible. Research results should be supported by empirical evidences.

DISCUSSION

Based on the observation sheet on the students' and teacher's activities, the average score was 89. From the results of the test T4, it was found that 15.8% still had thinking difficulty. It means that 84.2% of students have successfully completed their studies. This action does not require cycle II. The summary of the scores is shown in Table 4.

Table 4: The Summary of Test and Effectiveness Score

Action (n Subject)	**Action I (14 students)**		**Action II (19 students)**	
Test	T1	T2	T3	T4
Completness	0%	92,9%	0%	84,2%
Effectiveness	92,9%		84,2%	
The average of Effectiveness	88,6%			

In every material presentation, learning objectives are always conveyed. It is important for students to know the learning objectives to show how far and how deep they will learn. Lecturers must create a pleasant learning atmosphere so that students enjoy the learning process in class. Dahar (2008: 74) said that telling goals can shape students to activate motivation and focus attention on relevant aspects of learning. Risnanosanti (2016) stated that a comfortable learning environment will make students increase their self-confidence, have a high level of persistence in completing difficult tasks and never give up in completing the assignments.

In group discussions, students get a lot of benefits. The success of a person will bring the success of other students as stated by Orton (2002) in which students who are motivated and interested have a desire to learn more. Slavin (2012) added that the behavior of members (small groups) brings blessings to the group. According to Setiawan and Sari (2018) teachers must carry out good classroom management in teaching process using cognitive conflict approach.

In this study, students do not learn classically but learn cooperatively in small groups.

They sit heterogeneously in groups based on the academic ability consisting of 3 or 4 studnets. This new learning situation elicited a new response. They are enthusiastic about new friends like this but are a little less unified, reluctant to ask and answer questions.

In the first session of each meeting, the researchers hope that students have varied ways to gain learning experiences. Therefore, the authors make a group learning setting and complete it with other strategies. Asma (2006) stated that cooperative learning causes the students' psychological elements to be aroused and more active, because of a sense of togetherness in groups, so that they can easily communicate in simpler language.

In implementing group learning strategies, the teachers hope that students will express everything that is on their mind. The presenter group tried to perform well and prepare it before. Listener students will be free to ask, argue or express their thoughts. Thus, it is likely that their new thinking difficulties will arise again.

Experiences showed that from year to year students made similar mistakes. Some of the causes as cited by some experts are correct, such as difficult trigonometric material and students' lack in mastering prerequisite material. However, in this study the cause was not a bad learning process, the physical condition of the students was weak and careless, because these three conditions could be manifested well by the teachers.

Those mistakes are including in thinking difficulty. Their cognitive network is in a disorganized state. The application of cognitive conflict strategies seeks to uncover wrong understandings and then correct them. It means that trying to organize their cognitive networks so that they will not be overlaped.

In the application of cognitive conflict strategies, their mistakes are shown and then the teachers against them with at least one example of denial. Then the correct concept or rules according to the syllabus were shown. On that occasion students will experience conflicts in their cognitive. With clear exposure from the teachers, they are able to repair or tidy up their cognitive network structure.

CONCLUSION

The application of cognitive conflict strategies is effective to overcome students' thinking difficulties with the level of effectiveness is 88.6%. Students' thinking difficulties are described in Table 2 and Table 3.

REFERENCE

Asma. N (2006). *Metode Pembelajaran Kooperatif*. Jakarta: Direktorat Jenderal Pendidikan Tinggi, Direktorat Ketenagaan.

Clement, M. N. (2010). *Analyzing Chil-dren's Error on Mathematical Taks. Education Studies in Mathe-matics.* 11.1-21.

Dahar, R.W (2010). *Teori-teori Belajar dan Pembelaj.* Jakarta: Penerbit Erlangga.

Davidson, J.E., dan Sternberg R.J. (2003). *The Psychology of Problem Solving*. Cambridge: Cambridge University Press.

Djasuli, M., Sa'dijah, C., Parta, I. N., & Daniel, T. (2017). Students' Reflective Abstraction in Solving Number Sequence Problems. *International Electronic Journal of Mathematics Education*

Gür, H. (2009). *Trigonometry Learning*. *New Horizons in Education*, Vol. 57, No. 1.

Hamalik, O. (2010). *Kurikulum dan pembelajaran*. Jakarta: Penerbit Bumi Aksara.

Lee, G. & Kwon, J. 2001. What Do We Know about Students' Cognitive Conflict in Science Classroom: A Theoretical Model of Cognitive Conflict Process. *Proceedings of the Annual Meeting of the Association for The Education of Teachers in Science.* Costa Mesa, CA: ERIC.

Mason, J., Burton, L., dan Stacey, K. (2010). *Thinking Mathematically*, *2nd Ed.* Harlow: Prentice Hall.

Moody, B. (2010). *Connecting the points: cognitive conflict and decimal magnitude*. In L.Sparrow, B. Kissane & C. Hurst (Eds.), Shaping the future of mathematics education.Proceedings of the Annual Conference of The Mathematics Education Research Groupof Australasia (pp. 422–429). Fremantle: MERGA

Mulyasa, E. (2007). *Menjadi Guru Profesi-onal*. Jakarta: P.T. Rosdakarya.

Mason, J., Burton, L., dan Stacey, K. (2010). *Thinking Mathematically*, *2nd Ed.* Harlow: Prentice Hall.

Nusantara, T**.,** Subanji, S., Susiswo. S,. (2019). *Characteristics of Students' Cognitive Conflict in Solving a Problem Based on Information Processing Theory* International Journal of Learning, Teaching and Educational Research *Vol. 18, No. 2, pp. 76-88*

Orton. A. (2002). *Learning Mathematics (Issues, Theory, and Classroom Practice).* London: British Library Cataloguing in Publication Data.

Parwati, N. N. (2008). *Pembelajaran Pers. Linear Satu Variabel dg. Imple-mentasi Strategi Konflik Kognitif pada Siswa Kelas I SLTP Lab. STKIP Singaraja.* Tesis IKIP Malang. Tidak Diterbitkan.

Pujianto, E., Masykuri, M., dan Utomo S.B. (2018) *Penerapan Strategi Konflik Kognitif untuk Pembelajaran Remidiasi Miskonsepsi Siswa pada Materi Kesetimbangan Kelas XII MIA SMAN 1 Sukoharj*o. Jurnal Pendidikan Kimia, Vol. 7 No. 1 Tahun 2018 Program Studi Pendidikan Kimia Universitas Sebelas Maret Hal. 77-85 ISSN 2337-9995

Ramlan. (2014). *Pemanfaatan Strategi Konflik Kognitif untuk Menumbuhkembangkan Kemampuan Berfikir Kritis dalam Pembelajaran Bangun Ruang pada Siswa Xa SMAN 1 Makasar*. Jurnal Matematika dan Pembelajaran Vol. 2, No. 1, Juni 2014.

Risnanosanti, R. (2016). Self Efficacy Mahasiswa terhadap Matematika dan Pembelajaran Berbasis Kegiatan Lesson Study. *Jurnal Elemen*, *2*(2), 127. https://doi.org/10.29408/jel.v2i2.316

Setiawan, W., & Andika Sari, V. T. (2018). Pengembangan Bahan Ajar Konsep Diferensial Berbasis Konflik Kognitif. *Jurnal Elemen*, *4*(2), 204. https://doi.org/10.29408/jel.v4i2.511

Shahbari, J.A., & Peled, I. 2014. Resolving Cognitive Conflict in A Realistic Situation With Modeling Characteristics: Coping With A Changing Reference in Fractions. *International Journal of Science and Mathematics Education*

Slavin, R. E. (2012). *Cooperative Learning Theory, Research, and Practice Second edition.* Boston: Allyn and Bacon.

Wiranata, A., Tandililing, E., Oktavianty, E. ((2011). *Pengaruh Strategi Konflik Kognitif terhadap Peningkatan Pemahaman Konsep pada Materi Gerak Parabola*. Program Studi Pendidikan Fisika FKIP Untan Pontianak

Wiriaatmadja, R. (2005). *Metode Penelitian Tindakan Kelas*. Bandung: PT. Remaja Rosdakarya.

Wyrasti, A. F., Sa'dijah, C., As'ari, A. R., & Sulandra, I. M. (2018). The Misanalogical Construction of Undergraduate Students in Solving Cognitive Conflict Identification Task. International Electronic Journal of Mathematics Education, 14(1), 33-47

Yusuf dan Munawir. (2003). *Pendidikan Bagi Anak dengan Problema Belajar*. Solo: Tiga Serangkai