ACTA DIDACTICA NAPOCENSIA
Volume 15, Number 1, 2022 - DOI: 10.24193/adn.15.1.8

EFFECT OF SUBJECT JIGSAW AND READING WRITING PRESENTATION TECHNIQUES ON ACADEMIC ACHIEVEMENT OF 7TH GRADE SCIENCE STUDENTS' ACADEMIC SUCCESS IN STRUCTURE AND PROPERTIES OF MATTER

Adem AKKUS, Kemal DOYMUS

Abstract: In this article a recently developed method, Reading Writing and Presentation (RWP) was introduced and compared with Subject Jigsaw Method (JG) and Control Group (CG). CG studied with present curriculum which was designed with respect to constructivism and issued by National Ministry of Education. Research was carried out with 7th grade elementary school students. Number of students included in RWP group was 22, in JG were 27 and in CG were 20. Thus, total number of the students enrolled in the study was 69. Research design was semi-experimental design with pre-test and post-test. Before the study all the students were given a pre-test. Pre-test results revealed that JG group had statistically significant academic achievement over CG. After implementing the study, students were given post-test and, both RWP and JG group had statistically better achievement than CG. Also JG had better statistical achievement than RWP. Students also were given a technique view form. Results revealed that RWP is a useful method in developing social and cognitive skills. It is also concluded by the study that constructivist designed curriculums supported with cooperative learning method increase academic achievement and students gain positive social skills

Key words: Jigsaw, Reading writing presentation, Reading writing application, Cooperative, Collaborative learning

1. Introduction

Qualified people are the foundations of economically developed countries. Poverty and power lie within knowledge, and that is only meaningful if citizens embrace it. However, citizens don't simply embrace the knowledge. In fact, it is an output of a process which is result of the educational system. Through education countries may solve the problems in work power, health, social norms etc. (Frederick, Schmidt & Davis, 2012). Consequently, educational system shouldn't only support the learning but other structures as well. In that case, schools turn into a place where a student learn scientific facts and develop moral values or social adaptation. Then, it is important to understand that needs and interest of every student occupies a place in the schools (Hamlen, 2012). Along with those, students' cognitive, social and physical well being is also demanded from schools. Learning environment supporting safety and good social relations between students and teachers, students and personnel, students and students support a pleasant environment and hence learning environment (Bear, Gaskins, Blank & Chen, 2011; Kurniawan, Effendi & Dwita, 2018). In that aspect, primary and elementary schools are in the focus since they are the first places where students encounter scientific facts (Dimick, 2012).

A traditionally set up instruction is based on exams which can't fulfill today's requirements since its results don't reflect the demands of the advances in life (Byrd, 2012). A learning environment supported with modern life materials creates a pleasant learning environment and supports the learning

Received February 2021.

Cite as: Akkus, A; & Doymus, K. (2022). Effect of subject jigsaw and reading writing presentation techniques on academic achievement of 7th grade science students' academic success in structure and properties of matter. *Acta Didactica Napocensia,* 15(1), 92-104, https://doi.org/10.24193/adn.15.1.8

(Daşdemir & Doymuş, 2012; Fu & Hwang, 2018). For that reason, lessons should exhibit scientific thinking skills and support activity of students while teaching the concrete bases of knowledge (Bozkurt, Orhan, Keskin & Mazi, 2008; Tran, Nguyen, Van De, Soryaly & Doan, 2019). Consequently, teachers are responsible for creating activities which help students to have rational thinking and inquiry based lifestyles (Feldman & Pirog, 2011; Siburian, Corebima & Saptasari, 2019). It should be noted that, quality of those activities is also a reflection of instruction quality in the classroom (Demirtaş, 2010). Studies indicate teachers incorporating activities into learning help their students whether they are academically successful students or not (Cohen-Vogel, 2011). Instructional activities may turn boring and dull lessons, identified by students, into fun and informative lessons (Feldman & Pirog, 2011) and that may be achieved through cooperative learning model (CLM) since CLM creates an active and fun learning environment (Cullen, 2012). Dewey is accepted as founder of CLM, and it is accepted widely that works of Vygotsky, Slavin, Piaget, Lewin, Bandura and Kagan contributed CLM (Cooper 2005; Çelik, Aytın & Bayram, 2013).

Social interaction and cooperation between the students are the basic foundations of CLM and language is the most important tool in the learning process. Teachers may, sometimes, miss the basics of verbal interaction since they may not be aware of the language used among students. However, this problem doesn't occur in the talks between the students since they use a common verbal language. Thus, students can create a way to understand the knowledge presented in the abstract topics. In fact, language is so important; some countries even build national policies to regulate the language in the text books with respect to students (Okebukola, Owolabi & Okebukola, 2013; Samsudin, Shamsudin, Arif & Faisal, 2017). CLM uses this common language for its advantage by increasing the social interaction among the students. Arguments between the students help them to remember what was in the text books. Another benefit of this interaction is to help the students on learning to compromise, realize the differences among themselves and accepting individual differences and, working in cooperation with each other (Byrd, 2012).

Due to attributes of CLM, there are many methods and techniques developed and being developed. One of those methods is Jigsaw method which was developed by Eliot Aronson in the beginnings of 1970. Later Jigsaw I, Jigsaw II, Jigsaw III, Jigsaw IV and Reverse Jigsaw were developed. Although each jigsaw technique was named differently, all of them have common basics (Evcim & İpek, 2013). The last developed Jigsaw technique is Subject Jigsaw technique which was developed by Doymuş in 2007 and studied in this research.

Another recently developed method is Reading Writing and Presentation (RWP) which was developed by Aksoy in 2011. RWP is based on reading and writing activities in cooperative working groups. Studies indicate in cooperative learning classrooms they develop positive attitude towards reading and exhibit positive reading skills. For that reason, first step of RWP is to increase the benefits of these skills (Cheng & Ku, 2009; Yusuf, Jusoh, & Yusuf, 2019). Studies point out that, families' attitudes toward reading or having books at home have statistically positive effects on children's reading habit. Yet, not every family presents positive attitudes towards reading. A person having good reading skills is also able to understand and comprehend the written materials easily and its effects might be seen in different areas. For example, people with high reading capacity to learn second language more easy. Thus, reading skills is not specific to an area or subject and a person having good reading skills will most probably show similar skills on different types of reading (Wolff, 2010). In addition to that, studies also indicate that students in primary and elementary schools understand the subject material when they read (Graham, Gillespie & McKeown, 2013).

Second step of RWP is making students to write reports. Reading written texts of students helps teachers to understand their students better and analyze how their students comprehend the subjects (Zumbrunn & Bruning, 2013). This is the reason why students are asked to write a report on the subject which was studied in the laboratories. Instructors are able to see how and up to what level their students can make analyzes and incorporate their analyzes with the knowledge they have. So, written materials by students are also reflection of their comprehension on the subject (Asoodeh, Asoodeh & Zarepour, 2012; Qiu & Lee, 2020). In that concept, purpose of this study is to determine effectiveness of JG and RWP techniques on academic achievement of 7th year elementary school students in structure and properties of matter unit.

Problem states of the study are;

1. Does subject jigsaw technique (JG) make statistical significant difference in academic achievement of 7th year elementary school students in structure and properties of matter unit with respect to current curriculum instruction?

2. Does reading writing and presentation technique (RWP) make statistical significant difference in academic achievement of 7th year elementary school students in structure and properties of matter unit with respect to current curriculum instruction?

3. Are JG and RWP techniques statistically superior to each other in academic achievement of 7th year elementary school students in structure and properties of matter unit?

2. METHOD

2. 1. Research design

Study was carried out with respect to quantitative research methods. Study design was pre-test, post-test and semi experimental design. This design is used to determine the effect of a variable on the concerned issue (Karasar, 2005).

2. 2. Study group

Three different 7th grade classrooms were randomly selected for the study. One classroom randomly selected as Reading Writing and Presentation (RWP) group. Other group randomly selected as Jigsaw (JG) and last group was selected as control group (CG). RWP group consisted of 22 students, JG group consisted of 27 students and CG consisted of 20 students. Thus, total number of students enrolled in the study was 69 students. Prior the study, all the groups were given a pretest in order to determine their academic knowledge level.

2. 2. Data collection tools

2.1.1. Pre-test. Pre-test questions were selected from the questions which were asked in text books and nationwide elementary school exams. 30 questions were selected for the pre-test and then specialists' and elementary teachers' views were taken on the prepared test. Specialists were academics from two different universities who had publications and education on the elementary school education. Teachers were elementary science teachers who were working actively. For pilot analysis, draft pre-test was given to 28 students studying 7th grade level. After analyzes five questions were omitted from the pre-test since they lowered the internal reliability of the pre-test. Thus, number of questions reduced to 25 for the pre-test. KR-20 value of the pre-test was .63.

2.1.2. Post-test. Post-test questions were selected from the questions which were asked in text books and nationwide elementary school exams. 30 questions were selected for the post-test and then specialists' and elementary teachers' views were taken on the prepared test. Specialists were academics from two different universities who had publications and education on the elementary schools education. Teachers were elementary science teachers who were working actively. For pilot analysis, draft post-test was given to 28 students studying 8th grade level. KR-20 reliability value of the post-test was .88 thus, all the questions retained in the post-test.

2.1.3. Instructional method view form. A semi-structured interview form was prepared and a pilot study was carried out with 10 elementary school students. Based on responses of the students a draft semi-structured instructional method interview form was prepared. Opinions of scholars who had the publications on cooperative learning method were taken and the draft interview form was finalized as instructional technique interview form.

2.1.4. Study steps. Curriculum and instructional materials followed in the classrooms were the same for all the groups as implemented by Ministry of Education. Thus, weekly duration of instruction,

topics' coverage etc. was same for all the groups. The only difference between the groups was the implemented study methods.

2.1.5. Study steps for control group. All the instruction, subunit order, materials and experiments were carried out with respect to present constructivist curriculum implemented by Ministry of National Education. After completing the unit a post-test was given to students.

2.1.6. Study steps for RWP group. RWP consists of three phase. Each phase was told in detail. First phase consists of reading phase. In reading phase students were given reading materials related to topics. Each student read the material. Teacher allocated enough time for the groups to finish the reading part.

After reading phase groups passed to writing phase. This was the second step of the RWP. Groups were responsible to write their group report. All the students in the groups contributed to the written report. After finishing the report, groups presented their report to teacher. Teacher carefully examined the written report and informed the group about missing points in the report and send report back to group to correct the problems and finalize the report. Groups corrected the reports and again presented to teacher. If there was no issue on the report then group passed to step three which was presentation.

In step three, presentation, groups presented their report to the whole classroom. If there wasn't enough time for all groups to make the presentations then, teacher or one of the students drew lot to determine the groups for making presentations. After presentations students were given academic achievement test (post-test).

3. FINDINGS

3. 1. Analyzes of achievement test results

3.1.1. Pretest results.

Descriptive statistics of pre-test results are presented in Table 1.

Table 1. *Descriptive statistics of pre-test results*

Tests	Groups	N	M	SD
Pre-test	CG	20	38,00	11,644
	JG	27	49,63	12,166
	RWP	22	42,73	15,875

Data in Table 1 indicated that JG group mean was higher than both CG and RWP group mean. RWP mean was higher than CG mean. To determine if there was a statistical significant difference between the groups a one-way Anova test was applied. Result of one-way Anova test result presented in Table 2.

Table 2. *One-way Anova pre-test result*

Groups	Sum of Squares	Df	Mean of Squares	F	p
Between groups	1611,108	2	805,554	4,538	0,014
Within groups	11716,660	66	177,525		
Total	13327,768	68			

Data in Table 2 revealed that there was a statistical significant difference between the groups [$F(2,66)= 4,538$; $p< 0,05$]. In order to determine which group had statistical significant difference a LSD test was applied and test result was presented in Table 3.

Table 3. *LSD test result of pre-test*

(I)Groups	(j) Groups	Mean Difference (I-J)	Standard Error	p
CG	JG	-11,630*	3,931	0,004
	RWP	-4,727	4,117	0,255
JG	CG	11,630*	3,931	0,004
	RWP	6,902	3,827	0,076
RWP	CG	4,727	4,117	0,255
	JG	-6,902	3,827	0,076

Data in Table 3 revealed that there was a statistical difference between JG group with CG in favor JG group.

3.1.2. Posttest results.

Descriptive statistics of post-test results are presented in Table 4.

Table 4. *Descriptive statistics of post-test results*

Tests	Groups	N	M	SD
Post-test	CG	20	41,60	11,923
	JG	27	62,37	14,895
	RWP	22	51,50	16,721

Data in Table 4 indicated that JG group mean was higher than both CG and RWP group mean. Same data indicated that RWP group mean was higher than CG mean. To determine if there was a statistical significant difference between the groups a one-way Anova test was applied. Result of one-way Anova test result presented in Table 5.

Table 5. *One-way Anova post-test result*

Groups	Sum of Squares	Df	Mean of Squares	F	p
Between groups	5018,476	2	2509,238	11,548	0,001
Within groups	14340,596	66	217,282		
Total	19359,072	68			

Data in Table 5 revealed that there was a statistical significant difference between the groups [$F(2,66)= 11,548$; $p< 0,05$]. In order to determine which group had statistical significant difference, a LSD test was applied and test result was presented in Table 6.

Table 6. *LSD test result of post -test*

(I)Groups	(j) Groups	Mean Difference (I-J)	Standard Error	p
CG	JG	-20,770*	4,349	0,001
	RWP	-9,900*	4,554	0,033
JG	CG	20,770*	4,349	0,001
	RWP	10,870*	4,234	0,013
RWP	CG	9,900*	4,554	0,033
	JG	-10,870*	4,234	0,013

Data in Table 6 revealed that there was a statistical difference among RWP group, CG and JG group in favor of JG group. Also data in Table 6 revealed that there was a statistical significant difference between CG and RWP group in favor of RWP group.

3. 2. Analyzes of technique view form results

Students' ideas on working in cooperative groups is presented in Table 7; Characteristics distinguished by students in themselves after working in cooperative groups is presented in Table 8; Understanding their level on different areas is presented in Table 9; Students' views' on working with friends is presented in Table 10; Students' views on their work effort in cooperative groups is presented in Table 11; Will of becoming group leader is presented in Table 12; Students' views on learning by themselves without help of teacher is presented in Table 13 and Students' preference on next cooperative group work is presented in Table 14.

3.2.1. Likert type view form results.

Table 7. *Students' views' on working in cooperative groups.*

Views	JG	RWP
Fun	3,4	3,5
Informative	4,1	4,0
Helpful	3,7	3,7

*Scores are based on 5 point scale

Students stated that working in cooperative groups was fun, informative and helpful

Table 8. *Characteristics distinguished by students in themselves after working in cooperative groups.*

Views	JG	RWP
I understand topic material very well	4,3	4,2
My self-confidence increased	4,1	4,1
My perspective enlarged	4,2	4,1
I achieved so many things on my own	4,8	4,3

*Scores are based on 5 point scale

Students stated positive ideas on characteristics distinguished in them.

Table 9. *Understanding their level on different areas.*

Views	JG	RWP
Problem solving	4,3	4,1
Preparing written documents	4,5	4,4
Making speeches	4,4	4,2
Working in group and with other groups	4,2	4,2
Organizing and planning	4,3	4,2
Efficiency on time management	4,2	4,2

*Scores are based on 5 point scale

Students stated positive views on their understanding level on different areas

3.2.2. View form results.

Table 10. *Students' views' on working with friends.*

Views	JG	RWP
Very good	36,1	36,4
Good	40,5	38,1
Enough	0,8	1,9
Bad	10,0	12,8
Very bad	12,6	10,8

*Scores are based on percentile

% 77,4 of JG and % 76,4 of RWP students think that working in cooperative groups was good. However, 22,6 % of JG and 23,6 % of RWP students think working with friends wasn't good.

Table 11. *Students' views on their work effort in cooperative groups.*

Views	JG	RWP
Very good	59,0	53,6
Good	22,3	23,2
Enough	11,6	16,1
Bad	6,3	5,4
Very bad	0,8	1,7

* Scores are based on percentile

% 92,9 of JG and % 92,9 of RWP students had positive ideas about their work effort. However, 7,1 % of JG and 7,1 % of RWP students do not have positive ideas about their work effort.

Table 12. *Will of becoming group leader.*

Views	JG	RWP
Yes	62,6	56,1
No	37,4	43,9

* Scores are based on percentile

More than half of JG and RWP group students wanted to be group leader in the next cooperative work session.

Table 13. *Students' views on learning by themselves without help of teacher.*

Views	JG	RWP
A lot	39,4	35,8
Some	52,6	55,3
Very few	7,1	7,1
Not at all	0,9	1,8

* Scores are based on percentile

% 60,6 of JG and % 64,2 of RWP students stated that they need help of teacher in learning.

Table 14. *Students' preference on next cooperative group work.*

Views	JG	RWP
Studying other courses	64,3	57,2
Using time efficiently	49,1	48,2
Making better job-share with group mates	77,6	69,6
Making research from more sources	55	60

* Scores are based on percentile

% 64,3 of JG and % 57,2 of RWP students stated that they want to work in cooperative groups in the other courses. % 49,1 of JG and % 48,2 of RWP students stated that they want to use time efficiently in the next cooperative work sessions. % 77,6 of JG and % 69,6 of RWP students stated that they want to make better job-share in the next cooperative work sessions. % 55 of JG and % 60 of RWP students stated that they want to make research from more sources in the next cooperative session.

4. Discussion and conclusion

Pre-test results of subject jigsaw (JG) and Control group (CG) indicated that JG group mean was 11,63 point higher than CG mean (Table 1) and, statistical analyzes revealed that this difference was significant and in favor of JG (Table 3). Analyzes of post-test results indicated that JG group mean was 20,77 point higher than CG mean (Table 4) and that difference was statistically significant in favor of JG (Table 6). In addition, JG increased mean point difference by 9,14 point. For that reason, it

may be said that that, although Turkish Ministry of Education designed elementary school curriculums with respect to constructivist approach, increase in JG mean point indicated that curriculums supported with subject jigsaw technique created more meaningful learning for the students. Literature covers studies revealing similar results that students benefit the Jigsaw methods (Artut & Tarim, 2007; Crone & Portillo, 2013; Demir, 2012; Doğru & Ünlü, 2012; Doymuş, Şimşek & Bayrakçeken, 2004; Halimah & Sukmayadi, 2019; Nurwanti, Asrifan & Haedar, 2019; Saputra, Joyoatmojo, Wardani & Sangka, 2019). Further discussion on RWP technique and data analyzes of RWP will reveal more insight about cooperative learning methods.

Pre-test analyzes revealed that RWP group mean was higher 4,73 point than CG (Table 1). On the other hand, statistical analyzes revealed that this difference was not significant and groups had similar prior academic knowledge level (Table 3). For that reason, it may be said that any occurred statistical difference after the study was due to applied instructional techniques. Post-test analyzes revealed that RWP had increased the mean point difference up to 9,90 point with CG (Table 4). Statistical analyzes revealed that this difference was significant and in favor of RWP group (Table 6). Based on the results, it might be said that a constructivist designed curriculum supported with RWP technique increased students' academic success and students' comprehension on the covered materials. Due to that fact, RWP group achieved academic success. Although RWP is a newly developed technique its success on increasing students' academic achievement were output by some studies (Aksoy & Doymuş, 2011; Aksoy & Doymuş, 2012a; 2012b; Okur Akcay, 2012). Further discussion made on both JG and RWP will reveal more insight.

Pre-test results indicated that JG group mean was 6,90 point higher than RWP group mean (Table 1). On the other hand, statistical analyzes revealed that this difference was not significant and groups had similar prior academic knowledge level (Table 3). Pos-test results indicated that JG group students increased mean difference with RWP up to 10,87 point (Table 4) and that difference was statistically significant in favor of JG (Table 6). Thus, it may be said that JG technique helped students to achieve academic achievement better than RWP method in structure and properties of matter unit. Yet, when both techniques were analyzed together with respect to CG mean point, it might be said that both RWP and JG methods helped students to achieve academic success. As discussed above JG technique is a successful technique for increasing students' academic and social skills. Although RWP is a newly developed technique, it also provided academic success. Within our knowledge only three study compared RWP's effectiveness with JG method. Gürbüz, Şimşek & Berber (2015) made a similar study on teaching social sciences for the 6th grade students. However, none of the groups obtained a statistically significant difference in academic achievement. Another study compared the effectiveness of Jigsaw, RWP and computer supported animations to determine the effectiveness of the methods. However, Researchers stated that no significant difference was found between JG and RWP group (Koç, Yıldız, Çalıklar & Şimşek, 2016). Lastly, a similar study done by Akdağ & Şimşek (2019). However, researchers didn't find statistical significant differences between the groups. Thus, based on this study, it may be said that both RWP method and subject jigsaw technique increased the academic achievement of students in RWP group. There are studies in the literature also state that cooperative learning methods are helpful in increasing students' academic achievement (Aghajani & Adloo, 2018; Aydın, 2011; Durukan, 2011; Genlott & Grönlund, 2013; Marzban & Akbarnejad, 2013; Sawyer, Obeid, Bublitz, Schwartz, Brooks & Richmond, 2017; Tarhan, Ayyıldız, Ogunc & Sesen, 2013; Wiratno, 2020; Zoghi, 2013).

Students' ideas about implemented techniques would provide better insights and comparison opportunities. Students indicated that working in cooperative learning methods was fun, informative and helpful (Table 7) and, they comprehended topic materials better, enlarged their perspectives when encountered with different ideas, had the pleasure of achievement and felt the increase in their self-confidence (Table 8). % 81,3 of JG and % 76,8 of RWP groups' students took responsibility of their work (Table 11). For example More than half of the students in the groups stated they want to be group leader in the next cooperative group work (Table 12) and already had the idea on what to do for the next cooperative group work (Table 14). % 76,6 of JG and % 74,5 of RWP group students worked in harmony with group mates (Table 10), and developed better cognitive and affective skills (Table 9). On the other hand, it is noteworthy that students still needed the guidance of teacher (Table 13).

Literature supports positive outcomes of CLM which were also indicated by the student responses (Aktaş, 2013; Ahmadi, İsmail & Abdullah, 2012; Demirdağ & Kartal, 2011; Genç & Şahin, 2012; Güngör & Özkan, 2011; Gürbüz, Çakmak & Derman, 2012; Hortigüela Alcalá, Hernando Garijo, Pérez-Pueyo & Fernández-Río, 2019; Koops, Vleuten, Leng & Snoeckx, 2012; Munawar, 2019; PharmD & PharmD, 2012; Rivera-Pérez, Fernandez-Rio & Iglesias Gallego, 2021; Sadeghi, 2013; Van Ryzin & Roseth, 2018; Veldman, Van Kuijk, Doolaard & Bosker, 2020).

Recommendation and Limitation

This study was only carried out on one curriculum unit with a relatively small sample. This study is limited with 7th grade elementary school students. Thus, a longitudinal study could be carried out with a bigger study group.

References

Aghajani, M. & Adloo, M. (2018). The Effect of Online Cooperative Learning on Students' Writing Skills and Attitudes through Telegram Application. International Journal of Instruction, 11 (3), 433-448.

Ahmadi, M.R., İsmail, H.N. & Abdullah, M.K.K. (2012). Improving vocabulary learning in foreign language learning through reciprocal teaching strategy. International Journal of Learning & Development, 2 (6), 186-201.

Aktaş, M. (2013). Researching the effect of the 5e learning model and cooperative learning metod on attitude in biology lesson. Gazi University Journal of Gazi Educational Faculty GUJGEF, 33 (1), 109-128.

Aksoy, G. (2011). Effects of reading-writing-application and learning together methods on student's understanding of laboratory experiments in science and technology course. Unpublished Doctorate Thesis. Atatürk University, Erzurum, Turkey.

Aksoy, G. & Doymuş, K. (2011). Effects of cooperative reading-writting-application technique in application in science and technology course. Gazi University Journal of Gazi Educational Faculty (GUJGEF), 31 (2), 381-397.

Aksoy, G. & Doymuş, K. (2012a). Effects of reading-writing-application and learning together methods on students' academic achievements. Trakya Journal of Education, 2 (1), 47-59.

Aksoy, G. & Doymuş, K. (2012b). Effects of reading-writing-application and learning together methods on students' experimentals skills. Trakya Journal of Education, 2 (1), 61-69.

Asoodeh, M.H., Asoodeh, M.B. & Zarepour, M. (2012). The impact of student-centered learning on academic achievement and social skills. Procedia – Social and Behavioral Sciences, 46, 560-564.

Artut, P.D, & Tarim, K. (2007). The effectiveness of jigsaw II on prospective elementary school teachers. Asia-Pacific Journal of Teacher Education, 35 (2), 129-141.

Aydın, S. (2011). Effect of cooperative learning and traditional methods on students' achievements and identifications of laboratory equipments in science technology laboratory course. Educational Research and Reviews, 6 (9), 636 - 644.

Bear, G.G., Gaskins, C., Blank, J. & Chen, F.F. (2011). Delaware School Climate Survey-Student: Its factor structure, concurrent validity, and reliability. Journal of School Psychology 49, 157-174.

Bozkurt, O., Orhan, A.T., Keskin, A. & Mazi, A. (2008). The effect of cooperative learning method to the academic achievement in science and technology lesson. The Journal of Turkish Social Research, 2, 63-78.

Byrd, D. (2012). Social Studies Education as a Moral Activity: Teaching towards a just society. Educational Philosophy and Theory, 44 (10), 1073-1079.

Cheng, Y-C. & Ku, H-Y. (2009). An investigation of reciprocal peer tutoring. Computers in Human Behavior, 25, 40-49.

Cohen-Vogel, L. (2011). "Staffing to the Test": Are today's school personnel practices evidence based?. Educational Evaluation and Policy Analysis, 33 (4), 483-505.

Cooper, M.M. (2005). An introduction to small-group learning. Pearson Prentice Hall: NJ

Cullen, D.M. (2012). Model engagement for your students. Journal of Chemical Education, 89, 565-566.

Crone, T.S. & Portillo, M.C. (2013). Jigsaw variations and attitudes about learning and the self in cognitive psychology. Teaching of Psychology, 40 (3), 246-251.

Çelik, S., Aytın, K. & Bayram, E. (2013). Implementing cooperative learning in the language classroom: opinions of Turkish teachers of English. Procedia Social and Behavioral Sciences, 70, 1852-1859.

Daşdemir, İ. & Doymuş, K. (2012). The effect of using animation on primary science and technology course students' academic achivement, retention of knowledge and scientific process skills. Pegem Eğitim ve Öğretim Dergisi (PEGEGOG), 2 (3), 33-42.

Demir, K. (2012). An evaluation of the combined use of creative drama and Jigsaw II techniques according to the student views: case of a measurement and evaluation course. Procedia-Social and Behavioral Sciences, 47, 455-459.

Demirdağ, B. & Kartal, M. (2011). Students' opinions about web assisted collaborative learning in anorganic chemistry. Journal of Buca Faculty of Education, 29, 36-49.

Demirtaş, Z. (2010). The relationship between school culture and student achievement. Education and Science, 35 (158), 3-13.

Dimick, A.S. (2012). Student empowerment in an environmental science classroom: toward a framework for social justice science education. Science Education, 96 (6), 990-1012.

Doymuş, K. (2007). Effects of a Cooperative Learning Strategy on Teaching and Learning Phases of Matter and One-Component Phase Diagrams. Chemical Education Research, 84 (11), 1857-1860.

Doğru, M. & Ünlü, S. (2012). The effects of employing the jigsaw iv technique in science and technology education upon students' motivation, science anxiety and their academic achievement. Mediterranean Journal of Humanities, 2 (2), 57-66.

Doymuş, K., Şimşek, Ü. & Bayrakçeken, S. (2004). İşbirlikli öğrenme yönteminin Fen Bilgisi dersinde akademik başarı ve tutuma etkisi [Effect of cooperative learning model on academic achievement and attitude in science course]. Journal of Turkish Science Education, 1 (2), 103-115.

Durukan, E. (2011). Effects of cooperative integrated reading and composition (CIRC) technique on reading-writing skills. Educational Research and Reviews, 6 (1), 102-109.

Evcim, H. & İpek, Ö.F. (2013). Effects of Jigsaw II on academic achievement in English prep classes. Procedia – Social and Behavioral Sciences, 70, 1651-1659.

Feldman, A. & Pirog, K. (2011). Authentic science research in elementary school after-school science clubs. Journal of Science Education and Technology, 20, 494-507.

Frederick, A.B., Schmidt, S.J. & Davis, L.S. (2012). Federal policies, state responses, and community college outcomes: Testing an augmented Bennett hypothesis. Economics of Education Review, 31, 908-917.

Fu, Q. K. & Hwang, G. J. (2018). Trends in mobile technology-supported collaborative learning: A systematic review of journal publications from 2007 to 2016. Computers & Education, 119, 129-143.

Genç, M. & Şahin, F. (2012). The effects of cooperative learning on eight grade students' metacognitive skills. Journal of Düzce University Institute of Social Sciences, 2 (1), 5-25.

Genlott, A.A. & Grönlund, A. 2013. Improving literacy skills through learning reading by writing: the iWTR method presented and tested. Computers & Education, 67, 98-104.

Graham, S., Gillespie, A. & McKeown, D. (2013). Writing: importance, development, and instruction. Reading and Writing, 26 (1), 1-15.

Gürbüz, H., Çakmak, M. & Derman, M. (2012). The effect of jigsaw on students' environmental education academic success and students' views about this technique. The Black Sea Journal of Social Sciences, 7, 1-12.

Güngör, S.N & Özkan, M. (2011). A study on the effect of cooperative learning method on students' attitude in teaching science and technology. Journal of Uludag University of Faculty of Education (JUUFE), 24 (1), 47-59.

Halimah, L. & Sukmayadi, V. (2019). The role of" jigsaw" method in enhancing indonesian prospective teachers' pedagogical knowledge and communication skill. International Journal of Instruction, 12 (2), 289-304.

Hamlen, K.R. (2012). Academic dishonesty and video game play: Is new media use changing conceptions of cheating?. Computers & Education, 59, 1145 - 1152.

Hortigüela Alcalá, D., Hernando Garijo, A., Pérez-Pueyo, Á. & Fernández-Río, J. (2019). Cooperative learning and students' Motivation, social interactions and attitudes: perspectives from two different educational stages. Sustainability, 11 (24), 7005.

Karasar, N. (2005). Bilimsel Araştırma Yöntemleri[Scientific Research Methods]. 15th edition. Ankara: Nobel Yayın Dağıtım

Koç, Y., Yildiz, E., Çaliklar, S. & Simsek, U. (2016). Effect of jigsaw II, reading-writing-presentation, and computer animations on the teaching of light unit. Educational Research and Reviews, 11 (20), 1906-1917.

Koops, W.JM., Vleuten, C.PM.V.D., Leng, B.A.D. & Snoeckx, L.H. (2012). Computer supported collaborative learning in a clerkship: an exploratory study on the relation of discussion activity and revision of critical appraisal papers. BMC Medical Education, 12 (79), 1-7

Kurniawan, J., Effendi, Z. M. & Dwita, S. (2018, July). The Effect of School Environment, Family Environment and Learning Motivation on Students' Learning Performance. In First Padang International Conference On Economics Education, Economics, Business and Management, Accounting and Entrepreneurship (PICEEBA 2018) (pp. 43-48). Atlantis Press.

Marzban, A. & Akbarnejad, A.A. (2013). The Effect of Cooperative Reading Strategies on Improving Reading Comprehension Of Iranian University Students. Procedia – Social and Behavioral Sciences, 70, 936-942.

Munawar, H. (2019). The application of STAD-Cooperative learning model: Efforts to increase motivation and learning outcomes of students in Class 5 SD N 07 Ledok Salatiga in Mathematics subjecth in Folding Symmetry and Rotating Symmetry topics. Mudarrisa: Jurnal Kajian Pendidikan Islam, 11 (2), 114-135.

Nurwanti, N., Asrifan, A. & Haedar, H. (2019). The application of cooperative learning: jigsaw ii technique in improving students' reading comprehension of expository text. Journal of Advanced English Studies, 2 (1), 31-40.

Okebukola, P.A., Owolabi, O. & Okebukola, F.O. (2013). Mother tongue as default language of instruction in lower primary science classes: tension between policy prescription and practice in Nigeria. Journal of Research in Science Teaching, 50 (1), 62-81.

Okur Akçay, N. (2012). The effects of group investigation, reading-writing-presantation and learning together methods from cooperative learning for teaching of force and motion subjects. Unpublished Dissertation, Atatürk University, Erzurum, Turkey.

PharmD, D.R.M & PharmD, J.L.H. (2012). Instructional design and assessment. Incorporating active-learning techniques and competency assessment into a critical care elective course. American Journal of Pharmaceutical Education, 76 (7), 1-6.

Qiu, X. & Lee, M. K. (2020). Regulated learning and self-efficacy beliefs in peer collaborative writing: An exploratory study of L2 learners' written products, task discussions, and self-reports. System, 93, 102312.

Rivera-Pérez, S., Fernandez-Rio, J. & Iglesias Gallego, D. (2021). Effects of an 8-week cooperative learning intervention on physical education students' task and self-approach goals, and emotional intelligence. International Journal of Environmental Research and Public Health, 18 (1), 61.

Sadeghi, M.R. (2013). On the investigation of effects of cooperative learning oncritical thinking; a case of Iranian university EFL context. The Iranian EFL Journal, 9 (2), 364-379.

Samsudin, Z., Shamsudin, Z., Arif, M. & Faisal, M. (2017). The application of Bandura's social learning theory in the teaching of academic writing. Global Journal of Business & Social Science Review, 5 (2), 1-9.

Saputra, M. D., Joyoatmojo, S., Wardani, D. K. & Sangka, K. B. (2019). Developing Critical-Thinking Skills through the Collaboration of Jigsaw Model with Problem-Based Learning Model. International Journal of Instruction, 12 (1), 1077-1094.

Sawyer, J. E., Obeid, R., Bublitz, D., Schwartz, A. M., Brooks, P. J. & Richmond, A. S. (2017). Which forms of active learning are most effective: Cooperative learning, writing-to-learn, multimedia instruction, or some combination?. Scholarship of Teaching and Learning in Psychology, 3 (4), 257.

Siburian, J., Corebima, A. D. & SAPTASARI, M. (2019). The correlation between critical and creative thinking skills on cognitive learning results. Eurasian Journal of Educational Research, 19 (81), 99-114.

Tarhan, L., Ayyıldız, Y., Ogunc, A. & Sesen, A. (2013). A jigsaw cooperative learning application in elementary science and technology lessons: physical and chemical change. Research in Science & Technological Education, 31 (2), 184 - 203.

Tran, V. D., Nguyen, T. M. L., Van De, N., Soryaly, C. & Doan, M. N. (2019). Does cooperative learning may enhance the use of students' learning strategies?. International Journal of Higher Education, 8 (4), 79-88.

Van Ryzin, M. J. & Roseth, C. J. (2018). Cooperative learning in middle school: A means to improve peer relations and reduce victimization, bullying, and related outcomes. Journal of educational psychology, 110 (8), 1192-1201.

Veldman, M. A., Van Kuijk, M. F., Doolaard, S. & Bosker, R. J. (2020). The proof of the pudding is in the eating? Implementation of cooperative learning: differences in teachers' attitudes and beliefs. Teachers and Teaching, 26 (1), 103-117.

Wiratno, P. (2020). Improving students' writing ability through cooperative learning type jigsaw. JETA (Journal of English Teaching and Applied Linguistic), 1 (2), 28-38.

Wolff, U. (2010). Subgrouping of readers based on performance measures: a latent profile analysis. Reading and Writing, 23, 209-238.

Yusuf, Q., Jusoh, Z. & Yusuf, Y. Q. (2019). Cooperative learning strategies to enhance writing skills among second language learners. International Journal of Instruction, 12 (1), 1399-1412.

Zoghi, M. 2013. Let's Cross the Rubicon: strengthening reading comprehension instruction. Procedia-Social and Behavioral Sciences, 70, 537-543.

Zumbrunn, S. & Bruning, R. (2013). Improving the writing and knowledge of emergent writers: the effects of self-regulated strategy development. Reading and Writing, 26 (1), 91-110.

Authors

Adem Akkus, Mus Alparslan University, Mus (Turkey). E-mail: ademakkus@gmail.com

Kemal Doymus, Ataturk University, Erzurum (Turkey). E-mail: kdoymus@atauni.edu.tr

Acknowledgement

Authors of this report especially thank TUBİTAK for its support by the project with number 110K252. This study is derived from author's PhD dissertation