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Research Article

The Effects of Mobile Computer-Supported Collaborative Learning to Improve Problem Solving and Achievements

Eka Budhi SANTOSA[1], I Nyoman Sudana DEGENG[2]; SULTON[3]; Dedi KUSWANDI[4]

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Abstract
This research aims to prove whether mobile Computer-Supported Collaborative Learning (mCSCL) is better at improving learning outcomes to solve problems than mobile Computer-Supported Individual Learning (mCSIL) based on the student's Self Regulated Learning level. Data analysis techniques in this study used SPSS programs with two-way variance analysis. The research subjects involved 140 Harapan Bangsa Academy students. The results of the analysis found that mCSCL has an average of 67,071 provides better learning outcomes for problem-solving than mCSIL, which is 63,414. Also, this study found that students with higher Self Regulated Learning (SRL) had better learning achievement than students with lower Self Regulated Learning that is, 66.5 compared to 63.986. Furthermore, the test results also obtained Fab = 3,326 with Sig. = 0.07 then H_0AB is accepted. This matter means the mCSCL and mCSIL learning strategies provide equally good learning achievements for students who have high or low Self Regulated Learning. The novelty of this study is that the mobile Computer-Supported Collaborative Learning strategy will be more effective in improving problem-solving learning outcomes if students have high Self Regulated Learning.

Keywords:
mobile Computer-Supported Collaborative Learning, mobile Computer-Supported Individual Learning, Self Regulated Learning, Problem Solving

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[1] Doctoral program students, Department of Instructional Technology, State University of Malang, Jl. Semarang No. 5 Malang, East Java, Indonesia (ekabudhis.journal@gmail.com), Orcid no: 0000-0002-5748-3176.
[2] Professor, Department of Instructional Technology, Faculty of Education, State University of Malang, Indonesia (nyoman.sudana.d.fip@um.ac.id), Orcid no: 0000-0003-4684-552X
[3] Associate Professor, Department of Instructional Technology, Faculty of Education, State University of Malang, Indonesia (sulton.fip@um.ac.id)
[4] Associate Professor, Department of Instructional Technology, Faculty of Education, State University of Malang, Indonesia (dedi.kuswandi.fip@um.ac.id), Orcid no: 0000-0003-1005-6641

Introduction

Collaborative Learning is group-based learning with face-to-face learning, through computer networks, or a mixture of both (Tsiatsos, Andreas, & Pomportsis, 2010). Collaborative learning developed by using computer aids is called Computer-Supported Collaborative Learning (Stahl, 2010). The characteristics of CSCL are using computer technology to facilitate collaboration, discussion, and exchange of knowledge between students (peers), students with teachers, or teachers and students to achieve learning goals (Ludvigsen, 2016; Stahl, Suthers, & Hesse, 2007; Stahl, 2017). The basic elements of CSCL are positive interdependence between individuals, accountability, interpersonal skills, the interaction between individuals and groups (Laal & Laal, 2012).

Compared to other learning models, CSCL can make students have higher intrinsic and extrinsic motivation (Serrano-Cámara, Paredes-Velasco, Alcover, & Velazquez-Iturbide, 2014). Other researchers conclude that CSCL can help improve the dynamics of the learning process because students are actively involved in learning activities (Weinberger, Marttunen, Laurinen, & Stegmann, 2013; Cress, Wodzicki, Bientzle, & Lingnau, 2011). Related to the development of information and communication technology, CSCL is a model of future learning that will make it easier for everyone to learn, collaborate and discuss each other both directly and virtually (Rosé & Ferschke, 2016 Lipponen, 1999). The concept of education that utilises information technology in teaching and learning is also able to improve student learning outcomes (Saputro & Susilowati, 2019).

Mobile devices such as laptops and smartphones are now a potential learning media (Sung, Chang, & Liu, 2016) and proven ability to improve student learning achievement (Kattayat, Josey, & Asha, 2017). This is related to the development of wireless technology and various mobile device innovations that make it easy for students to study wherever and whenever (Sung, Chang, & Yang, 2015; Chinnery, 2006). New features in mobile phones also make it easier for users to have social connectivity (Alvarez, Alarcon, & Nussbaum, 2011), so collaborative learning can still be done even though students are separated by time and space (Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sanchez, & Vavoula, 2009; So & Brush, 2008). Even the development of cellular technology at this time can replace many functions of Personal Computers, so it is often used to be the main tool in collaborative learning (CL). In the context of learning research, this condition then forms a new research sub-field of CSCL called mobile Computer-Supported Collaborative Learning (mCSCL) (Fu & Hwang, 2018; Resta & Laferrière, 2007). An important element is the integration of the characteristics of mobile devices with collaborative learning (Baloch, Abdul Rahman, & A Ihad, 2012). Thus the mobile Computer-Supported Collaborative Learning (mCSCL) is defined as the use of mobile devices

as a learning tool in the classroom and outside the classroom in a collaborative learning environment (Carapina & Boticki, 2015; Zurita & Nussbaum, 2004).

Previous researchers found that mCSCL can increase students' active participation in learning activities because the use of mobile devices makes it easy for students and peers to interact with each other (Lestari, Maksum, & Kustandi, 2019; Parsons, Petrova, & Ryu, 2012). Smartphone technology with sophisticated computing capabilities has enabled mCSCL to be more efficient, making it easier for each group member to coordinate and interact using video calls or chat even if separated by place and time (Kurubacak & Altinpulluk, 2017; Caballé, Xhafa, & Barolli, 2010). For this reason, mCSCL which uses a smartphone is very suitable for learning (Echeverrí et al., 2011; Damyanov & Tsankov, 2018), able to improve concept understanding, application of concepts and problem-solving in various disciplines, such as environmental problems, nursing, mathematics, computer programming, natural sciences and language learning (Y. C. Hsu & Ching, 2013). However, all of the above research is in the context of the characteristics of students who do not have special talents, while learning for gifted students is encouraged to use independent learning models (Tortop, 2014). In this study, the characteristics of students who are the object of research are heterogeneous and do not care about their special talents.

Mobile Computer-Supported Collaborative Learning (mCSCL) requires supporting software to build a dynamic, collaborative learning environment (Vega-Gorgojo et al., 2008; Andreas, Tsiatsos, Terzidou, & Pomportsis, 2010). Much network-based learning software can be used to help the collaborative learning process, although teachers still have to develop and design relevant pedagogical aspects (Khandaker, Soh, Miller, Eck, & Jiang, 2011). One of the supporting software that can be used to develop Collaborative Learning environments is Edmodo Social Learning Networks (SLNs). The advantages of this application are free and safe (Balasubramanian, Jaykumar, & Fukey, 2014), One of the supporting software that can be used to develop Collaborative Learning environments are Edmodo Social Learning Networks (SLNs). The advantages of this application are free and safe easy to use (Kongchan, 2012), many are perceived well by students (Enriquez, 2014) and proved to be profitable (Durak, 2017). Edmodo also proved able to facilitate blended learning (Purnawarman, Susilawati, & Sundayana, 2016), and able to facilitate effective learning communication and save time (Al-Said, 2015).

Mobile Computer-Supported Collaborative Learning requires adequate Regulated Learning so that the learning process takes place effectively (Järvelä & Hadwin, 2013). This is related to the characteristics of mCSCL, which requires students to be able to manage their learning (Littlejohn, Hood, Milligan, & Mustain, 2016). The ability to motivate themselves and organise their learning that students

must have is related to the nature of mobile learning that is inherent to Self Regulated Learning (Sha, Looi, Chen, & Zhang, 2012).

Students with adequate Self Regulated Learning can create and maximise their study time (Yau & Joy, 2008). Self Regulated Learning can affect student learning and learning outcomes (Zimmerman, 1990). Students with high Self Regulated Learning will have significantly higher learning achievement (Dörrenbächer & Perels, 2016; Reimann & Bannert, 2018). Learning that integrates formal and informal using social media requires good Self Regulated Learning and Personal Learning Environment (Dabbagh & Kitsantas, 2012) whereas Self Regulated Learning and student motivation are influenced by student emotions, which have an impact on academic achievement (Mega, Ronconi, & De Beni, 2014). Thus, Self Regulated Learning as a characteristic of students needs attention in mobile learning Computer-Supported Collaborative Learning to improve learning outcomes to solve problems (Shi, Frederiksen, & Muis, 2013). In the context of a country that has a developing digital infrastructure such as Indonesia, mobile Computer-Supported Collaborative Learning (mCSCL) has not been much investigated for its benefits and effectiveness in learning. Therefore, this research is important.

Problem of Research

This research will answer the following questions;

- Is there a difference in learning achievement in solving problems between students who are taught using mobile Computer-Supported Collaborative Learning (mCSCL) and those who are taught using the mobile Computer-Supported Individual Learning (mCSIL) strategy?
- Are there differences in learning achievement in solving problems between students who have high Self Regulated Learning and students who have low Self Regulated Learning?
- Is there an interaction between mobile Computer-Supported Collaborative Learning (mCSCL) and Self Regulated Learning in problem-solving learning achievement?

Method

Research Model

The research model in this study is quasi-experimental with experimental factorial design (2x2) version of Control Group Design (Tuckman, 1999). The researcher did not randomly choose subjects to be involved in the treatment because the class was structured. A quasi-experimental design is used with the consideration that in determining the experimental group can not be done by random selection, but by random assignment sampling of existing classes. Researchers used an intact group in which all subjects were given treatment.

The research involved two experimental groups, namely the group that was treated and the other group as a control group. The independent variable (X), which observed its effect on the dependent variable (achievement) was the mobile Computer-Supported Collaborative Learning (mCSCL) Strategy and the mobile Computer Supported Individual Learning (mCSIL). While the moderator variable (Y) is Self Regulated Learning which is divided into two dimensions, namely high Self Regulated Learning and low Self Regulated Learning. Furthermore, the application of learning strategies will be observed to influence the learning outcomes of solving problems for anti-corruption education courses.

Table 1.
Research Design

Group	Pre-test	Treatment	Post-test
1	O_1	X_1	O_2
2	O_1	X_2	O_2

Participants

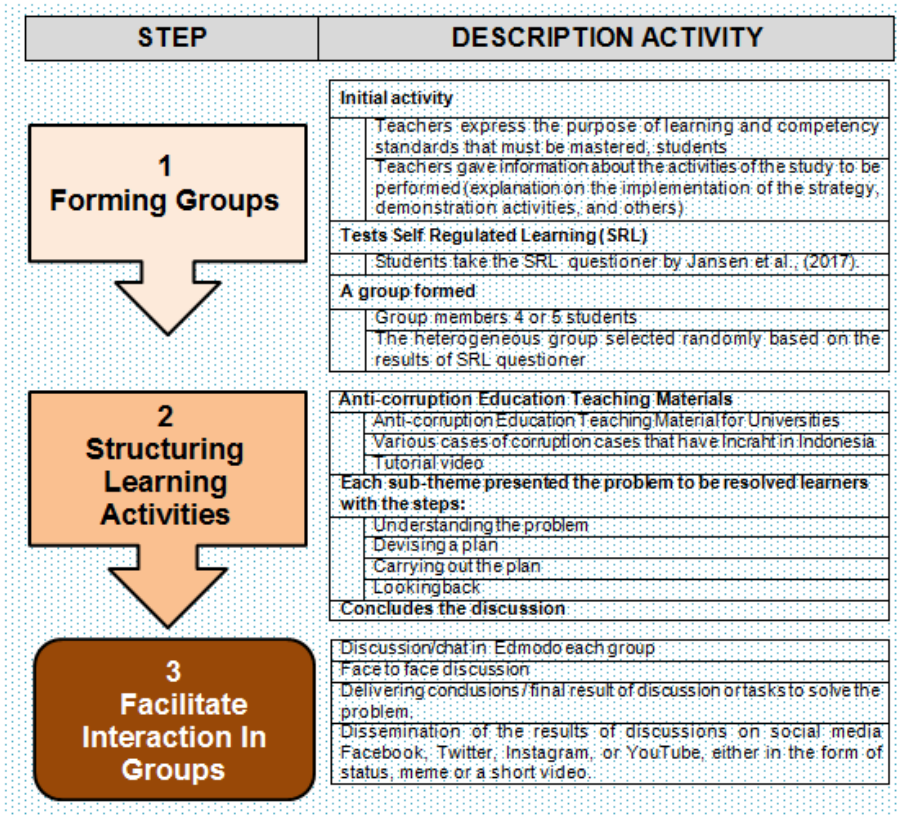
This research requires two groups of subjects according to the learning strategy to be applied. The total research subjects consisted of 140 students of the Harapan Bangsa Academy in Surakarta who took an Anti-Corruption Education course. The first group consisted of 70 students subjected to the treatment of mobile Computer-Supported Collaborative Learning (X1) and the second group which also consisted of 70 students subjected to the treatment of mobile Computer-Supported Individual Learning (X2).

The sex of the subjects consisted of 98 women (70%) and 42 men (30%). The mobile Computer-Supported Collaborative Learning (X1) treatment in the first group was divided into 17 collaboration groups, where 15 collaboration groups consisted of 4 people and 2 collaboration groups consisted of 5 people.

Procedure

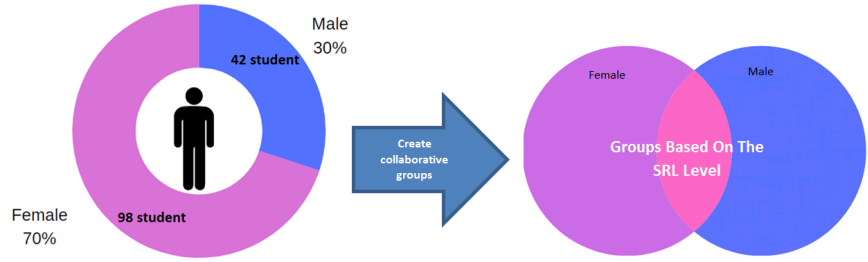
At the beginning of the learning process, a Self Regulated Learning test is conducted. The instrument for measuring student's Self-Regulated Learning consisted of 34 statements that were modified from instruments developed by Janssen (Jansen, van Leeuwen, Janssen, & Kester, 2018). Then a pre-test is conducted to determine the student's initial abilities. At the end of the study, a post-test was conducted to measure the effect of treatment. This study consisted of 1 treatment class (mCSCL) and 1 control class (mCSIL), each consisting of 70 students. The learning activities are carried out 10 times learning time, consisting of 8 times face-to-face learning time with a duration of 30 to 60 minutes, followed by online classes using Edmodo Social Learning Networks (SLNs). Whereas 2 times the other study time is used to do the SRL questionnaire, do the Pre-test and Post-test.

Syntax of Computer-Supported Collaborative Learning, according to Graham and Misanchuk (2014) (Roberts, 2005) is stated as follows:



Picture 1

Syntax mCSCL learning (Graham dan Misanchuk, 2014)



Picture 2

Gender variations and collaboration groups

The structure of anti-corruption education teaching materials is as follows: 1). Students can explain the understanding and factors that cause corruption; 2). Students can solve bribery problems; 3). Students can solve the problem of embezzlement cases in positions; 4) Students can solve the problem of Extortion cases; 5) Students can solve the problem of cheating cases; 6). Students can solve the problem of Interest cases in the procurement of goods & services; 7). Students can

solve Gratification case problems; 8). Students can solve the problem of the failure of anti-corruption education socialisation for adolescents in Indonesia.

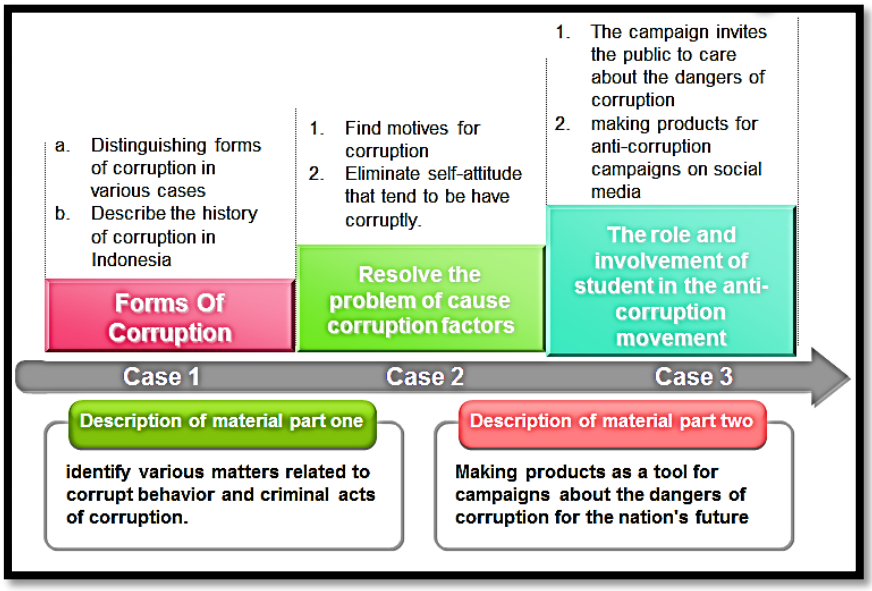


Figure 3.
Structure of Anti-Corruption Education Teaching Materials

Learning activities carried out face-to-face and virtual, both in the classroom and outside the classroom. The Edmodo application is used for sharing material, assignments, discussions and proposing tasks or collaboration products for small groups.

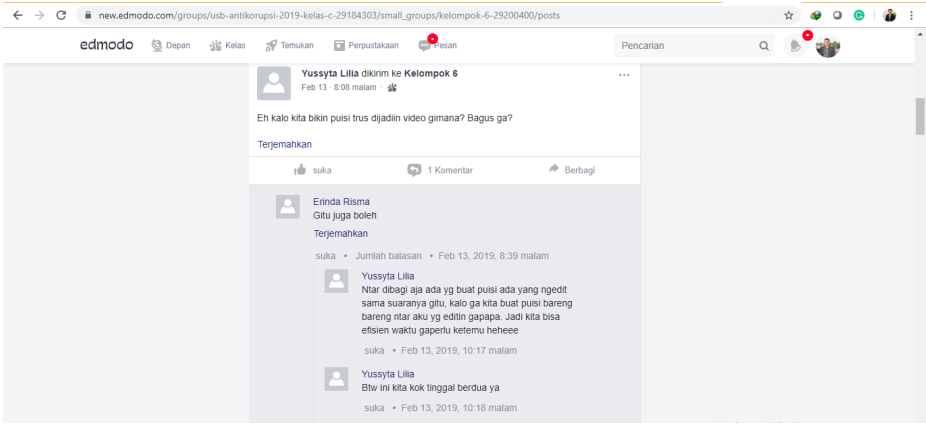


Figure 4.
Chat Discussion in Small Groups

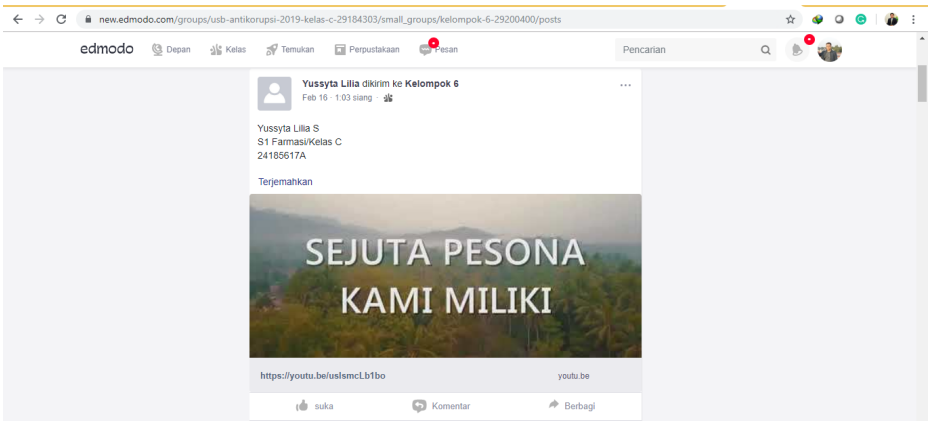


Figure 5.

Student Collaboration Products in the Form of Anti-Corruption Socialization Videos on Social Media

Data Instruments and Analysis

The instruments used in this study are 1). Self Regulated Learning Questionnaire, 2). Pre-test question of problem-solving for Anti-Corruption Education, 3). Post-test question of problem-solving for Anti-Corruption Education. Determination of the level of Self Regulated Learning research subjects based on the value of the Self Regulated Learning questionnaire adopted from the Validation of the self-regulated online learning questionnaire (Jansen et al., 2017). Five aspects measured in Self Regulated Learning can be seen in the table below:

Table 2.

Self Regulated Learning Test Items Based on Measured Aspects

No	Measured aspects	Amount
1	Metacognitive skills	16
2	Time management	3
3	Environmental structuring	5
4	Persistence	5
5	Help-seeking	5
Total		**34**

While the instrument of ability to solve problems of corruption cases is done according to the steps of solving the problem. Furthermore, the results are assessed using a rubric to assess the abilities of themselves and their colleagues (Greenstein, 2012). The rubric evaluates three components, namely a). Ability to identify problems, b). Ability to identify multiple solutions and c). The ability to maintain solutions. The value of each component includes four assumptions, namely expert with a value of 4, competent with a value of 3, apprentices with a value of 2, and novice with a value of 1. Pre-test assessment is carried out by the teacher at the

beginning of the learning session, while the post-test score is carried out by peers based on the answer key given by the teacher. The number of questions is as much as 3 questions of corruption cases in Indonesia.

Data analysis techniques in this study used the SPSS program with two-way variance analysis. The prerequisite tests used in the data analysis of this study were the normality test with the Lilliefors method and the homogeneity test with the Bartlett method.

Findings

Before analysing the data, the tabulation of the self-regulated learning test results and the pre-test and post-test results are first tabulated. The normality test and homogeneity test are then performed as a prerequisite before a two-way variant analysis is performed. In this study, it was found in Table 3 that the population was normally distributed and in the Table 4 population was homogeneous variance. The results of data analysis obtained a statistical description of learning achievement data presented by researchers in Table 5 and Table 6.

Table 3.

Tests of Normality

	Normality	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	d	Sig.
Data	mCSCL SRL High	.081	35	.200*	.986	35	.931
	mCSCL SRL Low	.112	35	.200*	.978	35	.687
	mCSIL SRL High	.135	35	.106	.961	35	.243
	mCSIL SRL Low	.118	35	.200*	.974	35	.571

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Table 4.

Levene's Test of Equality of Error Variances

Dependent Variable: Data

F	df1	df2	Sig.
1.326	3	136	.269

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

Table 5.

Description of Learning Achievement Test Data

Strategy (Y) / SRL (X)	Learning Strategies		Average Marginal
	mCSCL (Y1)	mCSIL (Y2)	
High Self Regulated Learning (X1)	67,514	65,486	66,5
Low Self Regulated Learning (X2)	66,629	61,343	63,986
Average Marginal	67,071	63,414	

Table 6.

Two Way ANOVA Test Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	782.200 [a]	3	260.733	9.342	.000
Intercept	595928.257	1	595928.257	2.135E4	.000
SRL H&L	221.257	1	221.257	7.928	.006
mCSCL&mCSIL	468.114	1	468.114	16.773	.000
Interaction	92.829	1	92.829	3.326	.070
Error	3795.543	136	27.908		
Total	600506.000	140			
Corrected Total	4577.743	139			

From Table 6, obtained Fx = 7.928 with the Sig. = 0, 006 then H0 is rejected. When viewed from the marginal mean, High Self Regulated Learning has a marginal average of 66.5 greater than Low Self Regulated Learning which is 63.986. These results indicate that Self Regulated Learning has a different effect on learning achievement.

Then, in Table. 6, Fy = 16.773 with Sig = 0.000, then H0 is rejected. When viewed from the marginal average, the mobile Computer-Supported Collaborative Learning strategy has an average of 67,071, greater than the Mobile Computer-Supported Individual Learning, which is 63,414. This shows that the mobile Computer-Supported Collaborative Learning strategy is more effective than the Mobile Computer-Supported Individual Learning.

The last Anova test results obtained Fab = 3.326 with Sig. = 0.07 then H0AB is accepted. So it can be concluded that students with high Self Regulated Learning and low Self Regulated Learning with mobile Computer-Supported Collaborative

Learning and mobile Computer Supported Individual Learning provide equally good learning achievement.

Discussion and Conclusion

The study found that mobile Computer-Supported Collaborative Learning is better at improving learning outcomes in solving problems than mobile Computer Supported Individual Learning. Many other studies agree with the results of this study, that collaborative learning is better than individual learning (Mason & Watts, 2011; Kolloffel, Eysink, & de Jong, 2011; Chen & Law, 2016; Weldon & Bellinger, 1997). This means that students in small groups who collaborate can solve problems better than those who do it individually. However, other studies do not agree with the results of this study which conclude that individual learning is better than collaborative learning under certain conditions (Escudero, León, Perry, Olmos, & Jorge-Botana, 2013). It is also different from other studies which concluded that there was no significant effect between individual and cooperative learning (Hary Soedarto Harjono, 2011). This difference can be explained by previous research which states that the performance of individuals in collaborative learning groups is better than not in groups, so that it has an impact on increasing learning achievement in problem-solving (Hill, 1982). Also, the poor learning outcomes of Individual Learning students are also caused by the low level of initial ability of each individual. So, when these individuals work alone, there are no triggers that can increase their emotions and motivation to learn. The impact of increased motivation and self-regulated learning of each individual in the group will affect group performance and individual learning achievement that increases (Mega et al., 2014).

This study also shows that the marginal average difference between the mobile Computer-Supported Collaborative Learning and mobile Computer-Supported Individual Learning is not large. One reason for the lack of maximum learning outcomes of collaborative groups is how the performance of individuals in collaborative groups (Järvelä & Hadwin, 2013). The resources of the group also determine the success of this mobile Computer-Supported Collaborative Learning method (Hill, 1982). Group performance will have an impact on individual learning outcomes in the Computer-Supported Collaborative Learning class (Siqin, Van Aalst, & Chu, 2016). This confirms previous research that the performance of small groups is strongly influenced by the level of self-regulated learning (Dörrenbächer & Perels, 2016) of each member and will have an impact on learning outcomes (Ahghar, 2013).

Another finding in this study is that the level of student's Self Regulated Learning largely determines their learning achievement in mobile Computer-Supported Collaborative Learning. Many previous studies also support the findings of this study which state that Self Regulated Learning determines learning achievement for

collaborative learning (Sha et al., 2012; Järvelä & Hadwin, 2013; Shi et al., 2013; Wong et al., 2019; Kramarski & Gutman, 2006; Littlejohn et al., 2016). However, several other findings disagree with the results of this study. Some stated that gender and study programs taken by students determine the success of smartphone-assisted learning (Yunita, Nursechafia, Setiawan, Nugroho, & Ramadhan, 2018; Zhan, Fong, Mei, & Liang, 2015; P. Hsu, Van Dyke, & Smith, 2017). The reason is that the gender factor influences more positive attitudes in socialisation among individuals in the group and will have an impact on each other's contribution to group work (Takeda & Homberg, 2014). Feeling comfortable in relationships between individuals in the group also influences group performance and has an impact on learning achievement (Theobald, Eddy, Grunspan, Wiggins, & Crowe, 2017). Another reason is based on previous research findings that the use of cellular technology in education sufficiently affects student motivation (Khaddage, Lanham, & Zhou, 2009). However, research findings supported by many findings from previous researchers, making the results of this study have a strong foundation.

Based on the problem of the study and the results of this study can be concluded as follows: (1) The learning strategy of mobile Computer-Supported Collaborative Learning provides better learning achievement than the mobile Computer Supported Individual Learning (Stahl, Koschmann, & Suthers, 2014; Mason & Watts, 2011; Kolloffel et al., 2011; Chen & Law, 2016; Chen & Law, 2016). (2) Students with high Self Regulated Learning have better learning achievement than students with low Self Regulated Learning (Sha et al., 2012; Järvelä & Hadwin, 2013; Shi et al., 2013; Wong et al., 2019; Kramarski & Gutman, 2006; Littlejohn et al., 2016). (3) The mobile Computer-Supported Collaborative Learning and mobile Computer-Supported Individual Learning strategies provide equally good learning achievements for students who have high or low Self Regulated Learning. That was caused by the absence of interaction between SRL and learning strategies (Hill, 1982; Järvelä & Hadwin, 2013; (Siqin et al., 2016). Learning achievement in this research is the ability to solve problems in an anti-corruption education class.

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Biodata of the Authors

Eka Budhi Santosa was born in Central Java, Indonesia. He graduated with a Masters in Educational Technology from Sebelas Maret University. He is a lecturer at the Harapan Bangsa Academy. Currently, he is a student of the Instructional Technology Doctoral Program, Faculty of Education, State University of Malang.
Affiliation: State University of Malang, Indonesia. **E-mail:** ekabudhis.journal@gmail.com,
SCOPUS ID: - **WoS Researcher ID :** -

Prof. Dr I Nyoman Sudana Degeng, M.Pd was born in Denpasar, Bali, Indonesia. He is a Professor of Instructional Technology at the State University of Malang. He has written several learning theory books, as a learning consultant in many institutions and respected educational technology experts in Indonesia.
Affiliation: State University of Malang, Indonesia.
E-mail: nyoman.sudana.d.fip@um.ac.id
SCOPUS ID: 57202321151 **WoS Researcher ID :** -

Dr. Sulton, M.Pd. was born in Malang, East Java, Indonesia. He is an Associate Professor of Instructional Technology at the State University of Malang. He graduated with a bachelor's degree in education in 1983, a master's degree in education in 1992, a doctor in Instructional Technology in 2003 from State University of Malang.
Affiliation: State University of Malang, Indonesia.
E-mail: sulton.fip@um.ac.id
SCOPUS ID: 57205652834 **WoS Researcher ID :** -

Dr. Dedi Kuswandi, M.Pd. was born in Bandung, West Java, Indonesia. He is an Associate Professor of Instructional Technology. Currently, he is the coordinator of the Learning Technology Doctoral Program in Malang State University. He also wrote extensively on research models and learning media published by various journals. **Affiliation:** State University of Malang, Indonesia **E-mail:** dedi.kuswandi.fip@um.ac.id
SCOPUS ID: 57194130351 **WoS Researcher ID :** -

References

Ahghar, G. (2013). Effect of Problem-solving Skills Education on Auto-Regulation Learning of High School Students in Tehran. *Procedia - Social and Behavioral Sciences*, *69*, 688-694.

Al-Said, K. M. (2015). Students' perceptions of Edmodo and mobile learning and their real barriers towards them. *Turkish Online Journal of Educational Technology* (TOJET), *14*(2),167-180.

Alvarez, C., Alarcon, R., & Nussbaum, M. (2011). Implementing collaborative learning activities in the classroom supported by one-to-one mobile computing: A design-based process. *Journal of Systems and Software, 184*(11), 1961-197

Andreas, K., Tsiatsos, T., Terzidou, T., & Pomportsis, A. (2010). Fostering collaborative learning in Second Life: Metaphors and affordances. *Computers and Education*, *55*(2), 603–615.

Balasubramanian, K., Jaykumar, V., & Fukey, L. N. (2014). A Study on "Student Preference towards the Use of Edmodo as a Learning Platform to Create Responsible Learning Environment." *Procedia - Social and Behavioral Sciences*, *44*, 416 – 422.

Baloch, H. Z., Abdul Rahman, A., & A Ihad, N. (2012). Mobile Collaborative Informal Learning Design: Study of collaborative effectiveness using Activity Theory. *International Journal of Interactive Mobile Technologies (IJIM, 6*(3), 34–41.

Caballé, S., Xhafa, F., & Barolli, L. (2010). Using mobile devices to support online collaborative learning. *Mobile Information Systems*. 6(1), 27-47.

Carapina, M., & Boticki, I. (2015). Technology trends in mobile computer-supported collaborative learning in elementary education from 2009 to 2014. *Proceedings of the 11th International Conference on Mobile Learning 2015, ML 2015*, (Nov. 2014), 139–143.

Chen, C. H., & Law, V. (2016). Scaffolding individual and collaborative game-based learning in learning performance and intrinsic motivation. *Computers in Human Behavior*, *55*(B), 1201-1212.

Chinnery, G. M. (2006). VoIM-Mediated Cooperative Tasks for English Language Learners. *English Teaching Forum*, *46*(4), 28-33.

Cress, U., Wodzicki, K., Bientzle, M., & Lingnau, A. (2011). CSCL for intellectually disabled pupils: Stimulating interaction by using a floor control mechanism. *International Journal of Computer-Supported Collaborative Learning*, *6*(2), 307–321.

Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *Internet and Higher Education*, *15*(1), 3-8.

Damyanov, I., & Tsankov, N. (2018). Mobile apps in daily learning activities. *International Journal of Interactive Mobile Technologies*, *12*(6), 133–140.

Dörrenbächer, L., & Perels, F. (2016). Self-regulated learning profiles in college students: Their relationship to achievement, personality, and the effectiveness of an intervention to foster self-regulated learning. *Learning and Individual Differences*, *51*, 229–241.

Durak, G. (2017). Using social learning networks (SLNs) in higher education: Edmodo through the lenses of academics. *International Review of Research in Open and Distance Learning*, *18*(1), 84-109.

Echeverrí, A., Nussbaum, M., Calderón, J. F., Bravo, C., Infante, C., & Vásquez, A. (2011). Face-to-face collaborative learning supported by mobile phones. *Interactive Learning Environments*, *19*(4),351-363.

Enriquez, M. A. S. (2014). Students ' Perceptions on the Effectiveness of the Use of Edmodo as a Supplementary Tool for Learning. *DLSU Research Congress*, March 6-8, 2014, LLI-II-010, 1-6.

Escudero, I., León, J. A., Perry, D., Olmos, R., & Jorge-Botana, G. (2013). Collaborative Versus Individual Learning Experiences in Virtual Education: The Effects of a Time

Variable. *Procedia - Social and Behavioral Sciences*. 83(2013), 367–370.

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 and Education*, *119*(1), 129-143.

Greenstein, L. (2012). *Assessing 21st Century Skills: A Guide to Evaluating Mastery and Authentic Learning*. California: Corwin Press.

Hary Soedarto Harjono, S. W. (2011). Is Cooperative Learning Better Than Individual Learning In Reading Comprehension Workshop ? *Tekno-Pedagogi, 1*(1), 1–13.

Hill, G. W. (1982). Group versus individual performance: Are N + 1 heads better than one? *Psychological Bulletin*, *91*(3), 517–539.

Hsu, P., Van Dyke, M., & Smith, T. J. (2017). The Effect of Varied Gender Groupings on Argumentation Skills among Middle School Students in Different Cultures. *Middle Grades Review*, *3*(2), 1–22.

Hsu, Y. C., & Ching, Y. H. (2013). Mobile computer-supported collaborative learning: A review of experimental research. *British Journal of Educational Technology*, *44*(5), E111-E114.

Jansen, R. S., Van Leeuwen, A., Janssen, J., Kester, L., & Kalz, M. (2016). Validation of the self-regulated online learning questionnaire. *Journal of Computing in Higher Education*, *29*(1), 6-27

Jansen, R. S., van Leeuwen, A., Janssen, J., & Kester, L. (2018). Validation of the Revised Self-regulated Online Learning Questionnaire. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Verlag*. 11082 (LNCS), 116–121.

Järvelä, S., & Hadwin, A. F. (2013). New Frontiers: Regulating Learning in CSCL. *Educational Psychologist*, *48*(1), 25-39.

Kattayat, S., Josey, S., & Asha, J. V. (2017). Mobile learning apps in instruction and students achievement. *International Journal of Interactive Mobile Technologies*, *11*(1), 143–147.

Khaddage, F., Lanham, E., & Zhou, W. (2009). A Mobile Learning Model for Universities -Re-blending the Current Learning Environment. *International Journal of Interactive Mobile Technologies (IJIM)*, *3*, 18–23.

Khandaker, N., Soh, L. K., Miller, L. D., Eck, A., & Jiang, H. (2011). Lessons learned from comprehensive deployments of multiagent CSCL applications I-MINDS and ClassroomWiki. *IEEE Transactions on Learning Technologies*, *4*(1), 46-58.

Kolloffel, B., Eysink, T. H. S., & de Jong, T. (2011). Comparing the effects of representational tools in collaborative and individual inquiry learning. *International Journal of Computer-Supported Collaborative Learning*. 6(2), 223–251.

Kongchan, C. (2012). How a Non-Digital-Native Teacher Makes Use of Edmodo. *Proceedings of the ICT for Language Learning International Conference 5th Edition 2012*. Firenze, Italia: Pixel Publication.

Kramarski, B., & Gutman, M. (2006). How can self-regulated learning be supported in mathematical E-learning environments? *Journal of Computer Assisted Learning*, *22*(1), 24 - 33.

Kukulska-Hulme, A., Sharples, M., Milrad, M., Arnedillo-Sanchez, I., & Vavoula, G. (2009). Innovation in Mobile Learning: A European Perspective. *International Journal of Mobile and Blended Learning (IJMBL)*, *1*(1), 13-35.

Kurubacak, G., & Altinpulluk, H. (2017). *Mobile Technologies and Augmented Reality in Open Education* (pp. 1-366). Hershey PA, USA: IGI Global.

Laal, M., & Laal, M. (2012). Collaborative learning: What is it? *Procedia - Social and Behavioral Sciences*, *31,* 491-495.

Lestari, I., Maksum, A., & Kustandi, C. (2019). Mobile Learning Design Models for State University of Jakarta, Indonesia. *International Journal of Interactive Mobile Technologies, 13*(9)

152-171.

Lipponen, L. (1999). The challenges for computer supported collaborative learning in elementary and secondary level: Finnish perspectives. *Proceedings of the 1999 conference on Computer support for collaborative (Pp.46-es).*

Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016). Learning in MOOCs: Motivations and self-regulated learning in MOOCs. *The Internet and Higher Education*, *29*, 40-48

Ludvigsen, S. (2016). CSCL: connecting the social, emotional and cognitive dimensions. *International Journal of Computer-Supported Collaborative Learning*. 11(2), 115–121.

Mason, W., & Watts, D. J. (2011). Collaborative learning in networks. *Proceedings of the National Academy of Sciences*, *109*(3), 764–769.

Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic Achievement. *Journal of Educational Psychology*, *106*(1), 121-131.

Parsons, D., Petrova, K., & Ryu, H. (2012). Mobile gaming - A serious business! *In Proceedings 2012 17th IEEE International Conference on Wireless, Mobile and Ubiquitous Technology in Education, WMUTE 2012 (Pp.17-24).*

Purnawarman, P., Susilawati, S., & Sundayana, W. (2016). The use of Edmodo in teaching writing in a blended learning setting. *Indonesian Journal of Applied Linguistics*, *5*(2), 242-252.

Reimann, P., & Bannert, M. (2018). Self-Regulation of Learning and Performance in Computer-Supported Collaborative Learning Environments. In *Handbook of Self-Regulation of Learning and Performance, Chapter 19* (*pp. 285–303).* New York: Routledge

Resta, P., & Laferrière, T. (2007). Technology in support of collaborative learning. *Educational Psychology Review*, *19*(1), 65-83.

Roberts, T. S. (2005). *Computer-Supported Collaborative Learning in Higher Education*. USA: Idea Group Publishing.

Rosé, C. P., & Ferschke, O. (2016). Technology Support for Discussion Based Learning: From Computer-Supported Collaborative Learning to the Future of Massive Open Online Courses. *International Journal of Artificial Intelligence in Education*. 26(2), 660–678.

Saputro, B., & Susilowati, A. T. (2019). Effectiveness of Learning Management System (LMS) on In-Network Learning System (SPADA) based on scientific. *Journal for the Education of Gifted Young Scientists*, *7*(3), 481–498.

Serrano-Cámara, L. M., Paredes-Velasco, M., Alcover, C. M., & Velazquez-Iturbide, J. Á. (2014). An evaluation of student's motivation in computer-supported collaborative learning of programming concepts. *Computers in Human Behavior*, *31,* 499–508.

Sha, L., Looi, C. K., Chen, W., & Zhang, B. H. (2012). Understanding mobile learning from the perspective of self-regulated learning. *Journal of Computer Assisted Learning*, *28*(4), 366-378.

Shi, Y., Frederiksen, C. H., & Muis, K. R. (2013). A cross-cultural study of self-regulated learning in a computer-supported collaborative learning environment. *Learning and Instruction*, *23*(Feb. 2013), 52-59.

Siqin, T., Van Aalst, J., & Chu, S. K. W. (2016). Fixed group and opportunistic collaboration in a CSCL environment. *International Journal of Computer-Supported Collaborative Learning*, *10*(2), 161–181.

So, H. J., & Brush, T. A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers and Education*, *51*(1), 318-336.

Stahl, G. (2010). Guiding group cognition in CSCL. *International Journal of Computer-Supported Collaborative Learning, 5*(3), 255–258.

Stahl, G. (2017). Group practices: a new way of viewing CSCL. *International Journal of Computer-Supported Collaborative Learning*, *12*(1), 113–126.

Stahl, G., Koschmann, T., & Suthers, D. (2014). Computer-supported collaborative learning. In *The Cambridge Handbook of the Learning Sciences, Second Edition*. Cambridge, UK: Cambridge University Press.

Stahl, G., Suthers, D. D., & Hesse, F. (2007). A double issue for CSCL 2007. *International Journal of Computer-Supported Collaborative Learning*, *2*(2–3), 127–131.

Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers and Education*, *94*, 252-275.

Sung, Y. T., Chang, K. E., & Yang, J. M. (2015). How effective are mobile devices for language learning? A meta-analysis. *Educational Research Review*, *16*(Oct. 2015), 68-84

Takeda, S., & Homberg, F. (2014). The effects of gender on group work process and achievement: An analysis through self- and peer-assessment. *British Educational Research Journal*, *40*(2), 373–396.

Theobald, E. J., Eddy, S. L., Grunspan, D. Z., Wiggins, B. L., & Crowe, A. J. (2017). Student perception of group dynamics predicts individual performance: Comfort and equity matter. *PLoS ONE*, *12*(7), 1–16.

Tortop, H. S. (2014). Examining the Effectiveness of the In-service Training Program for the Education of the Academically Gifted students in Turkey: A Case Study. *Journal for the Education of Young Scientists*, *2*(2) 67-67.

Tsiatsos, T., Andreas, K., & Pomportsis, A. (2010). Evaluation framework for collaborative educational virtual environments. *Educational Technology and Society*, *13*(2), 65–77.

Tuckman, B. W. (1999). *Conducting Educational Research*. Orlando: Harcourt Brace College Publishers.

Vega-Gorgojo, G., Bote-Lorenzo, M. L., Gómez-Sánchez, E., Asensio-Pérez, J. I., Dimitriadis, Y., & Jorrín-Abellán, I. M. (2008). Ontoolcole: Supporting educators in the semantic search of CSCL tools. *Journal of Universal Computer Science*, *14*(1) 27-58.

Weinberger, A., Marttunen, M., Laurinen, L., & Stegmann, K. (2013). Inducing socio-cognitive conflict in Finnish and German groups of online learners by CSCL script. *International Journal of Computer-Supported Collaborative Learning*, *8*(3), 333–349.

Weldon, M. S., & Bellinger, K. D. (1997). Collective memory: Collaborative and individual processes in remembering. *Journal of Experimental Psychology: Learning Memory and Cognition*. 23(5), 1160-1175.

Wong, J., Baars, M., Davis, D., Van Der Zee, T., Houben, G. J., & Paas, F. (2019). Supporting Self-Regulated Learning in Online Learning Environments and MOOCs: A Systematic Review. *International Journal of Human-Computer Interaction*, *35*(4–5), 356–373.

Yau, J. Y., & Joy, M. S. (2008). A Self-Regulated Learning Approach: A Mobile Context-aware and Adaptive Learning Schedule (mCALS) Tool. *International Journal of Interactive Mobile Technologies*, *2*(3), 52–57.

Yunita, A., Nursechafia, Setiawan, E., Nugroho, H., & Ramadhan, H. (2018). The relationship between mobile phone usage in the classroom and academic achievement in college life. *International Journal of Interactive Mobile Technologies*, *12*(8), 96–103.

Zhan, Z., Fong, P. S. W., Mei, H., & Liang, T. (2015). Effects of gender grouping on students' group performance, individual achievements and attitudes in computer-supported collaborative learning. *Computers in Human Behavior*, *48*(July 2015), 587-596.

Zimmerman, B. J. (1990). Self-Regulated Learning and Academic Achievement: An Overview. *Educational Psychologist*, *25*(1) 3-17.

Zurita, G., & Nussbaum, M. (2004). Computer supported collaborative learning using wirelessly interconnected handheld computers. *Computers and Education, 42*(3), 289-314.