Education Quarterly Reviews

Suseno, N., Ningsih, W., Salim, M. B., and Turmudi, D. (2022). The Influence of Grouping on the Quality of Collaboration in IPA-Physics SMP Instructional Using the E-Experiment Method in Sumatra Indonesia. *Education Quarterly Reviews*, 5(1), 126-137.

ISSN 2621-5799

DOI: 10.31014/aior.1993.05.01.424

The online version of this article can be found at:
https://www.asianinstituteofresearch.org/

Published by:
The Asian Institute of Research

The Asian Institute of Research *Education Quarterly Reviews* is a peer-reviewed International Journal. The journal covers scholarly articles in the fields of education, linguistics, literature, educational theory, research, and methodologies, curriculum, elementary and secondary education, higher education, foreign language education, teaching and learning, teacher education, education of special groups, and other fields of study related to education. As the journal is Open Access, it ensures high visibility and the increase of citations for all research articles published. The *Education Quarterly Reviews* aims to facilitate scholarly work on recent theoretical and practical aspects of education.

ASIAN INSTITUTE OF RESEARCH
Connecting Scholars Worldwide

The Asian Institute of Research
Education Quarterly Reviews
Vol.5, No.1, 2022: 126-137
ISSN 2621-5799

DOI: 10.31014/aior.1993.05.01.424

The Influence of Grouping on the Quality of Collaboration in IPA-Physics SMP Instructional Using the E-Experiment Method in Sumatra Indonesia

Nyoto Suseno[1], Wahyu Ningsih[1], M. Barkah Salim[1], Dedi Turmudi[2]

[1] Physics Education Study Program, Universitas Muhammadiyah Metro
[2] PPG, Universitas Muhammadiyah Metro

Correspondence: Dedi Turmudi, Teacher Profession Program(PPG), Universitas Muhammadiyah Metro, Metro Lampung Indonesia 34111. Tel: E-mail: tdeditur@gmail.com

Abstract
The grouping model of collaborative learning in the scope of physics learning is less discussed in secondary schools. This study aims to determine the effect of gendered-grouping on the quality of collaboration in Physics Science instructional and its effect on learning outcomes. This study uses an experimental approach with a posttest-only group design model that involves two different characteristics of classes. The sampling of this study consisted of class VIII.1 consisting of 27 students (12 males and 15 females) as a homogeneous group, and class VIII.2 consisting of 31 students (14 male and 17 female) as a heterogeneous group taken by random cluster sampling. Data collection uses observation and tests to obtain quantitative data. Data analysis employed comparative statistics on collaboration level data and correlation statistics between collaboration level data and learning outcomes. The result shows that the quality of collaboration and student learning scores from homogeneous groups is better than heterogeneous groups. The correlation test results show that the level of collaboration of students from heterogeneous classes has a significant correlation with their learning outcomes. The correlation values the equation: y = 1,242.x + 8.892, which means it has a positive effect. It is concluded that homogeneous grouping has a positive effect on the quality of collaboration and the acquisition of student learning outcomes. Therefore, in improving the quality of learning collaboration using the SMP Science-Physics experimental technique, a strategy with gender homogeneous grouping worth application.

Keywords: Collaboration, Group, Homogeneous, Heterogeneous, Experimental Technique

1. Introduction

1.1 Identified Problems

The grouping model of collaborative learning in the scope of physics learning is less discussed in secondary schools. Many recent studies focused the other variables and attributes of the targeted participants (A. Afifah et al., 2019; Aqel, 2013; Erkens et al., 2016; Le et al., 2017; Muuro et al., 2016; Nurdiyanto et al., 2018; Wulannita,

2013). Realizing this opportunity, we intent to fill the gaps as contribution to the body of knowledge. Therefore, one of the identified problems is the effect of homogeneous and heterogeneous grouping on the quality of collaboration in Physics Science learning and its effect on learning outcomes.

Prior studies focused on different variables and thus yielded heterogeneous empirical evidence. Among them are the effect of interaction in different level (Aqel, 2013), hypothetical evidence in mixing collaborative and individual learning (Alterman & Harsch, 2015), the impact of different group orientation techniques (Muuro et al., 2016), collaborative learning in Geography course (Erkens et al., 2016), perception on obstacle in collaborative learning (Le et al., 2017), collaborative learning with computer supported technology and level of self confidence in heterogenic and homogeny classes (Afifah et al., 2019). What has not been done in the previous studies are problems in the current study. Henceforth, we found clear discrepancies upon these synthesized articles and thus we are convinced to undergo the current study.

The expected outcomes comprise evidence if homogenous and heterogeneous collaboration framed in experimental learning instructional can increase the learners 'collaboration and learning achievement. The researchers believe that collaboration between students in learning is vital. With collaboration, students can develop their respective potentials and abilities that determine the success of their learning. Wicaksono (2015) claims that collaborative learning has characteristics that include dividing different roles during group work. In the end, each group member will exchange information and complement each other (Wicaksono, 2015). This model is known as jigsaw technique. Suseno & Riswanto (2017) define collaboration as an attitude of mutual giving shown by the willingness to accept or listen to others and the willingness to give or help others (Suseno & Riswanto, 2017).

1.2 Previous Related Empirical Evidence

Many teachers often employ group learning techniques, and heterogeneous groups, where each group consists of men and women with some conditions adjusted (Pérez-Escoda & Rodríguez-Conde, 2015). The tacit is to promote better participation, understanding, and learning outcomes. However, the impact is not balanced. During the discussion process, male students depend on female students to do assignments and deliver discussion results. Therefore, the learning process tends to be dominated by female students. Other impacts include learning outcomes of cognitive aspects in physics subjects are also less than optimal. Students who have not reached the KKM (minimum standard grade) reach 60%. Because of this, it is necessary to make efforts to improve student physics learning outcomes by using technique that are more appropriate and have a positive impact on the cognitive achievement of students and students in a balanced way.

One of the efforts that the teacher has made is to use the discussion technique. Alma et al. (2012) and other researchers stated that the discussion technique is exchanging information, opinions, and experiences. Discussion regularly intends to get a more transparent and thorough mutual understanding of the problems or being discussed topics (Alma & Al, 2012; Pollock et al., 2011; Whatley & Bell, 2003). The results of the application of this technique indicate that small groups are reported to have more high levels of participation and are better and more comfortable for students in expressing opinions. Small group discussions were also more helpful in imparting understanding than large groups (Pollock et al., 2011). In addition, collaboration is believed to be very positive by students between different countries (Whatley & Bell, 2003).

Another strategy is the experimental technique or procedure. We believe that using this procedure can improve students' cognitive achievement. Dittrich et al. (2016) claim that laboratory experiments can improve intuitive understanding in the form of knowledge and experience (Dittrich et al., 2016). In line with the opinion above, Suseno (2012) also reveals that the experimental technique could develop learning outcomes in attitudinal, cognitive, and psychomotor aspects (Suseno, 2012). Furthermore, according to Gandhi, et al (2016) experimental activities can improve two aspects at once, namely the development of the experiment and the development of student's cognitive abilities (Gandhi et al., 2016). According to Jones, et al. (2016) laboratories can strengthen students' understanding through facts (Jones, J. A., D'Addario, A. J., Rojec, B. L., Milione, G., & Galvez, 2016). Riswanto and Noviayu's research (2017) reveals that laboratory-based learning can improve science process skills

and encourage the formation of the character of responsibility and cooperation (Riswanto & Noviayu, 2017; Suseno & Riswanto, 2017). Suseno & Harjati (2016) suggest that experimental techniques can develop metacognitive abilities (Suseno, N. & Harjati, 2016). Drawing on these empirical and hypothetical evidence, we believe that experimental procedures or technique can cause positive collaboration and learning outcomes.

By implementing the experimental technique, students are allowed to conduct experiments to prove a concept. However, the studies found bias. The previous researchers reported this condition where students did not have enough collaboration skills. Many students were found busy themselves, not wanting to help other friends or being less active. The interaction between students did not go well, so that learning outcomes were less than optimal (Le et al., 2017).

The purpose of grouping is to let students collaborate because the quality of students is different. The students have to collaborate so that they learn from each other (Muuro et al., 2016; Nurdiyanto et al., 2018). However; if the group consists of many students, the interaction process takes longer, and the learning outcomes are also less than optimal. Therefore the number of group members must be well designed (Xiang & Jing, 2020). It is clear that grouping model has potential possibilities and thus the current study addresses this issue in the physics education.

Scholars revealed some reasons why types of grouping are important. Djamarah (2010) states that in large groups, interpersonal contact is problematic. So it is better in learning to use small groups (Djamarah, 2010). Responding to this claim, another scholar defined it clearly. Sanjaya (2006) proposed that small group discussions consist of 3-5 students (Sanjaya, 2006). Nevertheless, this model is open to a modification of heterogenous or homogenous group models.

Other scholar claims that homogenous groups have drawbacks. The lack of homogeneous groups is that there are not many differences honing the process of thinking, negotiating, and arguing. Whereas the advantage of heterogeneous groups is that they provide opportunities for mutual learning and support among group members. While the weakness is that it can reduce the focus of student learning because it is disturbed by the opposite sex (Lie, 2010). It is clear that heterogenous groupings in this context are to mix males and females' students.

Similar scholars revealed some commonsense findings. They reported that the social maturity of students from heterogeneous schools is higher than homogeneous schools (Ramanda, P., & Khairat, 2017). Meanwhile, Afifah et al. (2019) revealed that homogeneous classes caused students have fairly good self-confidence so that the competition created was even tighter among the students. Along this positive effects are also drawbacks. The disadvantages of heterogeneous groups include: students are embarrassed to ask about lessons and are less accessible, so that students' focus in learning is lacking (Aprilia Afifah et al., 2019). The insightful benefits and drawbacks are schemed clearly from empirical evidence and thus we shift to clarify the thinking framework.

1.3 Theoretical Framework

The grouping of students in learning in Indonesia tends to use heterogeneous because theories claim that heterogeneous groups are better than homogeneous groups. However, some other scholars claim that homogeneous groups can be better than heterogeneous groups. A study reports that homogeneous grouping provides better performance than heterogeneous grouping. This study reveals that the symmetrical interaction pattern in heterogeneous group is higher than the homogeneous group, but the asymmetric interaction is lower than the heterogeneous group (Wulannita, 2013). Also,
the advantages of homogeneous groups are increasing activity, character building, and learning focus, which simultaneously impact student learning outcomes.

Learning is a process of interaction between various learning components: between students and learning resources, between students and the learning environment, between students and teachers, and between students themselves (Aqel, 2013). One of the essential factors is the interaction between students to strengthen collaborative learning and strengthen the interaction model in learning (Suh & Lee, 2006). The process of interaction between students in learning is certainly mutually beneficial. With this interaction process, students collaborate to

complement and accept each other to increase knowledge, attitudes, and skills. Scholars suggest that collaboration means a mutually beneficial relationship between two or more parties who work with various responsibilities and authorities to achieve goals (Aminah & Sastramihardja, 2007). In particular, the effect of learning outcomes based on the mixed-gender groups scored significantly higher on overall attitude and confidence than female students in computer-supported collaborative learning (Zhan et al., 2015, p. 593).

There are several advantages of individual and collaborative learning models. Individual learning has its advantages; greater autonomy, personal identity, ownership, work on own phase, work on own cognitive style. While collaborative learning has advantages; inter psychological or common understanding, work in the proximal zone, metacognitive style, multiple viewpoints, social cohesion (Alterman & Harsch, 2015, p. 412). The survey results in several schools captured information that school facilities were adequate with science laboratories, computer laboratories, libraries, and other supporting facilities. Teachers who teach follow education; the learning technique methods used are pretty varied: group discussion technique, experimental technique, and demonstration technique.

The selection of homogeneous and heterogeneous groups in learning need serious attention to the objectives or targets of learning. For particular target abilities, it is more suitable to use homogeneous groups, and for other purposes, it is more suitable to use heterogeneous groups (Erkens et al., 2016; R. Gillies, 2004; R. M. Gillies & Boyle, 2010). This consideration may be applicable in any context of instructional but it may harvest different results.

1.4 Research Question

To encourage collaboration in learning using experimental technique methods, it is also necessary to pay attention to choosing homogeneous or heterogeneous groups. Therefore, it is necessary to study comparing the quality of collaboration and student learning outcomes between homogeneous and heterogeneous groups in learning using experimental technique. In connection with the research objectives above, the formulation of this research is:

1. How is the level of collaboration of homogeneous groups of students using the experimental technique?
2. How is the level of collaboration between heterogeneous groups of students using the experimental technique?
3. What are the learning outcomes of homogeneous groups of students using the experimental technique?
4. What are the learning outcomes of heterogeneous groups of students using the experimental technique method?

2. Method

2.1 Design

This study employed experimental design using comparative procedures and resulting quantitative data (Creswell, 2014). Thus the initial abilities of students are the same, so the design of this study is a posttest-only control group design. The independent variable (X1 and X2) is homogenous grouping and heterogeneous grouping while the dependent variable (YI and Y2) is level of collaboration and learning outcomes.

The operational definition of homogeneous in this research is grouping based on gender, not based on IQ. In contrast, the operational definition of a heterogeneous group in question is grouping based on mixed-gender, not on different IQs. Thus, a homogeneous group is a mixture of only male or female students, while a heterogeneous is a mixture of male and female students with different IQ levels.

2.1 Population and Sampling

The research was carried out at SMP Negeri 1 *Gunung Agung Tulang Bawang*, West Lampung. The researchers assume that there is no superior class. In this study, two variables X1 versus Y1 and X2 versus Y2 are addressed.

The experimental learning technique with homogenous grouping is independent variable or X1 and the experimental learning technique with heterogeneous grouping or X2. The quality of collaborative learning in homogeneous grouping is dependent variable or Y1 and the quality of collaborative learning in heterogeneous grouping is dependent variable or Y2.

This study used 2 (two) classes as samples: Class VIII.1, the learning process uses homogeneous groups, and class VIII.2, the learning processes heterogeneous groups, with each group consisting of 3-5 students. There is an aspect observed in the study, i.e., the level of collaboration and students' learning outcomes. We took participants as cluster random sampling under the model of scholars (Hatch & Farhady, 1981).

2.3 Instrument

The research instrument uses participant observation, posttest, and documentation. The qualitative observation data contains interaction mobility during the experiment to measure the level of collaboration. Later, the observation data were analyzed and converted ordinal datasets for statistic purposes. In contrast, the posttest is in the form of quantitative data in the form of students' final grades after working in homogeneous and heterogeneous groups—likewise, document data in the form of data descriptions of the condition of students. All instruments are interconnected to the validity of the sough data.

2.4 *Data Collection and Analysis*

The data collection technique in this study uses observation, documentation, and tests. The researchers have tested all instruments for statistical validation and reliability. Data analysis used comparative test statistics, and the data met the requirements for normality and homogeneity (Creswell, 2014).

We treated the participants to do experimental learning three times with two scenarios; homogenous grouping and heterogeneous grouping. They were observed and the description of interaction and mobility of the group collaboration was administered. Further, we assigned the participants post-test for all groups. Then, we scored the test using interval scores for statistical purpose.

All types of data were analyzed simultaneously. The observation data were categorized using criteria content analysis (Miles et al., 2014).However; the results were then converted into ordinal data to meet statistical tests. As for observation, the document data were synchronized with the observation and post-test data. Finally, the post-test was the last data collecting stage. The result of this process was analyzed to yield interval data or scores of learning achievement.

3. Result

The current study seeks to answer the four research questions. The results are described in the following:

3.1 Students' collaboration level in homogenous group

The histogram shows the result data of the collaboration student homogeneous group observation (Figure 1).

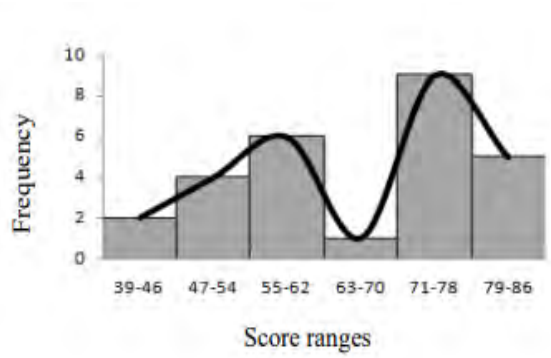

Figure 1: Data on the level of collaboration of homogeneous groups

The figure shows that the level of collaboration in homogenous group is respectively dominated by the score ranges of 71-78 and is followed by the score ranges of 55-62 and finally by the score ranges of 79-86. This result is higher than that of heterogeneous grouping as described in the next figure.

3.2 Students' collaboration level in heterogeneous group

In comparison to the histogram of collaboration level in homogeneous grouping is collaboration level in heterogeneous grouping. The result can be seen in figure 2.

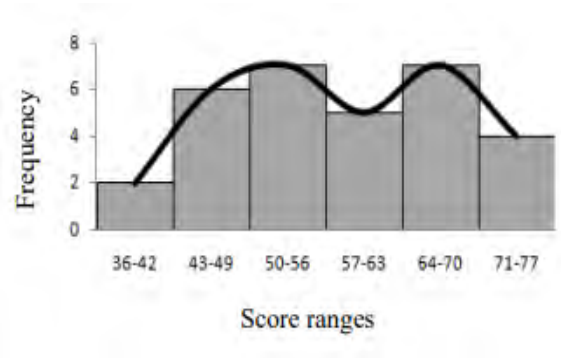

Figure 2: Data on the level of collaboration of heterogeneous groups

The figure shows that the level of collaboration is respectively dominated by the score ranges of 64-70, 50-56 and 43-49. This result is lower than the level of collaboration in homogeneous grouping as shown in figure 1 above.

Following homogenous and heterogeneous grouping is statistical test of them. The result of quantitative description of collaboration level data can be seen in the following table.

Table 1: Description of collaboration level data

	Homogeneous Group	Heterogeneous Group
Mean	66.6667	57.0000
N	27	31
Std. Deviation	13.13832	10.44988

The table shows that the mean of collaboration in homogenous group is 66.66 while the mean of collaboration in heterogeneous group is 57.00. In addition, the standard deviation (S.Dev.) in homogenous group is 13.13832 while in heterogeneous group is 10.44988.

This means that the average value of the collaboration level of a homogeneous group is higher than that of a homogeneous class.

The comparison test results using SPSS also obtained a significance value of 0.000, more diminutive than 0.05, which means that there is a significant difference. Thus, the researchers found that the collaboration quality of students in a homogenous group is better than in heterogeneous group.

3.3 *Students' learning outcomes of homogeneous groups*

In addition to level of collaboration, the students' learning outcomes are also addressed in the current study. The data on student learning outcomes with homogeneous groups is shown by a histogram as shown in Figure 3.

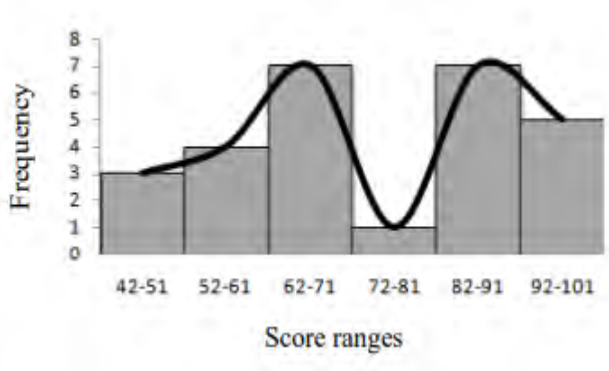

Figure 3: Result data of homogenous study group.

The figure shows that the students' learning outcomes in homogenous group are respectively dominated by score ranges of 82-91, 62-71 and 92-101. This result is higher than the counterpart grouping which means that homogenous grouping effect higher learning outcomes of the students. In comparison, the quantitative data of learning outcomes in heterogeneous grouping is described in the following part.

3.4 Students' learning outcomes of heterogeneous groups

The data on student learning outcomes with homogeneous groups is shown by a histogram as shown in Figure 4. This figure shows a histogram of the student learning outcomes data of heterogeneous groups.

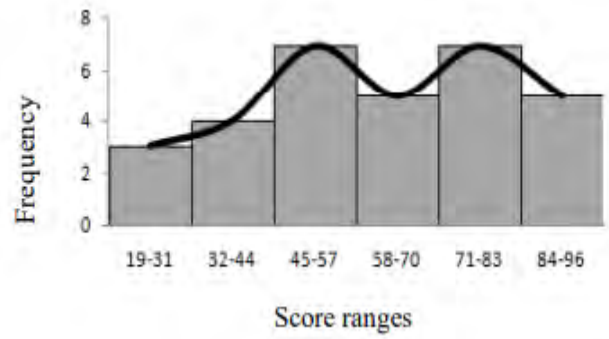

Figure 4: Data on learning outcomes of heterogeneous groups

The figure shows that the students' learning outcomes in heterogeneous group are respectively dominated by score ranges of 71-83, 45-57 and 84-94. This result is lower than the counterpart grouping which means that heterogeneous grouping effect less learning outcomes of the students. The result may be different in other subject than physics education.

The description of quantitative learning outcomes data is in Table 2.

Table 2: Comparative Description of Learning Outcomes

	Homogeneous Group	Heterogeneous Group
Mean	73.9259	61.0645
N	27	31
Std. Deviation	16.66393	20.20385

The table 2 shows that the mean of learning outcomes in homogenous group is 73.9259 while the mean of learning outcomes in heterogeneous group is 61.0645. In addition, the standard deviation in homogenous group is 16.66393 while in heterogeneous group is 20.20385.

This means that the average learning outcomes of a homogeneous group are higher than that of a homogeneous group.

The table 2 shows that the average value of learning outcomes for the homogeneous group is higher than the homogeneous group. The comparison test results using SPSS also obtained a significance value of 0.000, more diminutive than 0.05, which means there is a significant difference. Thus, in learning using the experimental method, student learning outcomes grouped homogeneously are better than student learning outcomes grouped heterogeneously.

Completing table 2 is the difference in the average level of collaboration on each indicator in more detail.

Table 3: Comparison of the Average Level of Collaboration between Homogeneous Groups and Heterogeneous Groups

No.	Indicators	Average	
		Homogeneous Group	Heterogeneous group
1	Students can build interaction.	68	61
2	Students exchange information.	59	54
3	Students work together to solve problems.	73	56

Table 3 shows the average score of collaboration. The homogenous group contributes higher level than that of heterogeneous in three indicators respectively 68.59, and 73 while that of heterogeneous is respectively 61, 54, and 56. This result indicates that student learning outcomes are also significantly affected by the quality of collaboration. The results of statistical tests show a correlation between the level of collaboration and learning outcomes, according to Table 4.

Table 4: Correlation test results between the level of collaboration and learning outcomes.

		Learning Outcomes	Quality of Collaboration
Pearson Correlation	Learning Outcomes	1.000	.979
	Level of Collaboration	.979	1.000
Sig. (1-tailed)	Learning Outcomes	.	.000
	Level of Collaboration	.000	.
N	Learning Outcomes	27	27

Based on Table 4, the correlation between the levels of collaboration and learning outcomes shows a significance value of 0.05, which means that there is a significant effect between the level of collaboration and learning outcomes. Based on The mathematical equation of the relationship between collaboration and learning outcomes is y = - 8,892 + 1,242.x.

Readers can see more details of the relationship between learning outcomes and the level of collaboration in the following graphics:

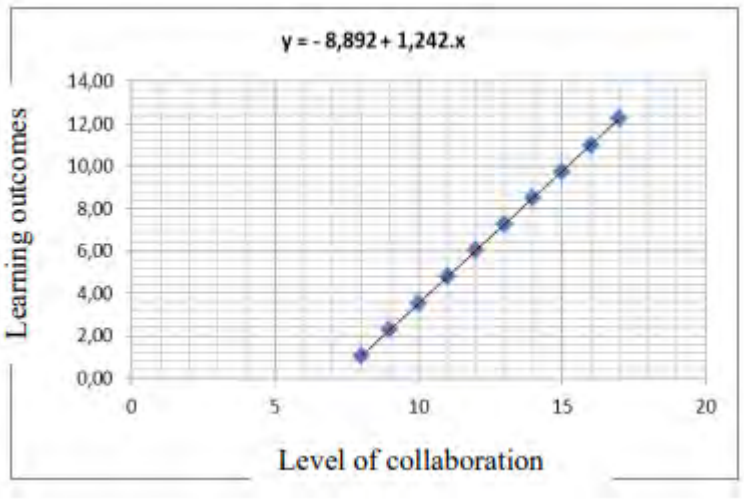

Figure 5: Graph of the relationship between the levels of collaboration with learning outcomes

The figure shows that level of collaboration influence the levels of learning outcomes significantly. Nevertheless, the current study reveals that collaboration in homogenous grouping contributes more than collaboration in heterogeneous grouping.

4. Discussion

The collaborative level data analysis results between homogeneous (male only or female only) and heterogeneous (mixed male and female) groupings showed significant differences. In general, the quality of class collaboration that uses homogeneous groups in the experimental method is better than classes that use heterogeneous groups. This finding confirms the previous finding where the experimental method was applied even though no gender grouping was reported (Dittrich et al., 2016). The heterogeneous grouping is confirmed to have bias (Lie, 2010) considering the statistical test as revealed in the previous study (Le et al., 2017). This finding also confirms previous studies where the experimental method can develop learning outcomes in attitudinal, cognitive, and psychomotor aspects (Suseno, 2012). The homogeneous grouping in the current study meets the condition of collaboration as proved by both empirical and hypothetical evidence. The students are hoped to collaborate well to harvest maximum learning outcomes (Muuro et al., 2016: Nurdiyanto et al., 2018). It is possible that the homogenous grouping makes students have good self-confidence so that they obtain higher learning outcomes (Arifah et al.,2019). Thus, the current findings confirm conditional contribution to the body of knowledge. Upon all, the laboratory experiment technique, in both homogeneous and heterogeneous group improve the students' cognitive, intuitive understanding, learning outcomes, and science proses skill (Dittrich et al., 2016; Suseno, 2012; Gandhi et al., 2016; Riswanto & Noviayu, 2017; Suseno & Harjati, 2016).

Table 3 shows the average level of collaboration for each indicator. Classes that use homogeneous gender groups are higher than heterogeneous groups, both aspects of building interaction, exchanging information, and working together to solve problems. This finding is in line with previous findings where small groups are reported to have higher levels of participation and are better and more comfortable for students in expressing opinions (Pollock et al., 2011). In addition, collaboration is believed to be very positive by students from different countries (Whatley & Bell, 2003). The discussion process that takes place in homogeneous groups tends to be more active than

heterogeneous groups. These results follow the findings of Affifah et al. (2019) that homogeneous groups lead to reasonably good self-confidence and research by Wulannita (2013) that the symmetrical interaction pattern of homogeneous groups is higher than classes with heterogeneous grouping. It means that the current study suggest homogenous grouping more than heterogeneous grouping in the context of physics education. This may not applicable in other courses and thus the finding is not absolute.

Following the level of collaboration is the result of learning outcomes. This study reveals that the student learning outcomes in homogeneous groups are also higher than the student learning outcomes in heterogeneous groups. The results of the statistical test also show a significant difference. These results follow Wulannita's (2013) research, which concluded that the homogeneous grouping performs better than the heterogeneous grouping with 57%. However, the context was in the course of biology. In addition, it is also in line with Lie's findings (2010) that the weakness of heterogeneous grouping is that it can reduce students' learning focus because they are disturbed by the opposite sex. The opposite gender distracts the process of collaboration due to feeling from being serious in doing analytical work in the current study.

The results of the linearity test also show that the mathematical equation model is linear. Where: y is the learning outcome, and x is the level of collaboration. Based on these equations, the researchers claim that if there is an increase in student collaboration, student learning outcomes will also increase according to the equation. This result is not confirmed by the prior studies statistically since the empirical evidence was mostly qualitative. Nevertheless, the findings are more or less confirmed by the prior studies(Dittrich et al., 2016; Suseno, 2012; Gandhi et al., 2016; Riswanto & Noviayu, 2017; Suseno & Harjati, 2016).

Wrapping research questions one to four, we are convinced that homogeneous grouping positively affects the quality of collaboration significantly and student learning outcomes in learning with the experimental technique.

5. Conclusion

Upon all findings and discussion we have come to conclusion. The level of collaboration of homogeneous groups is higher than that of heterogeneous groups in science-physics learning in junior high school using the experimental method. Homogeneous grouping in science-physics learning in junior high school using the experimental method has a better effect on the quality of collaboration than heterogeneous grouping. There is a significant relationship between the level of collaboration and the learning outcomes of Science-Physics in Junior High School using the experimental method. The learning outcomes of the homogeneous group are higher than the heterogeneous group in learning science-physics in junior high school using the experimental method.

This study was limited to few samplings in less developed areas. Pretest could have been done if the design were true experimental design. This study was experimental as method and laboratory experimental as treatment technique. The variable was merely contrasting homogenous and heterogeneous in gender and there were not any further attributes under gender variable such as low, medium, high attainment and low, medium and high learning motivation**.**

Provided the conclusions in the study, the authors put forward suggestions to improve the learning outcomes of Science-Physics Junior High School as follows. The strategy for selecting group forms in learning should pay attention to the goals or learning targets. Choosing a homogenous group strategy can improve the quality of collaboration in science-physics learning in junior high school using the experimental method in groups**.**

Acknowledgment

This study was funded by Campus research program of Universitas Muhammadiyah Metro for the data collection and analysis data. Thus, authors thanked Universitas Muhammadiyah Metro for the donor to fund the project under schema of OPR 2020. Authors also thank many anonymous parties who supported technical process and countless non-financial assistance.

References

Afifah, Aprilia, Hamidah, D., & Burhani, I. (2019). Studi komparasi tingkat kepercayaan diri (self-confidence) siswa antara kelas homogen dengan kelas heterogen di sekolah menengah atas[Comparative study of students' self-confidence between homogeneous and heterogeneous classes in high school]. *Happines*, *3*(1 Juni), 43–53.

Alma, B., & Al, E. (2012). *Guru profesional menguasai metode dan terampil mengajar [Professional teachers master the method and are skilled at teaching]*. Bandung: AlFabeta.

Alterman, R., & Harsch, K. (2015). Collaborative and individual learning - mixing the two. *Proceedings of the 7th International Conference on Computer Supported Education*, 411–417. https://doi.org/10.5220/0005476504110417

Aminah, S., & Sastramihardja, H. S. (2007). Kajian pemgembangan kerangka kerja kolaborasi evaluasi dengan pendekatan collaborative business process[A study on the development of a collaborative evaluation framework with a collaborative business process approach]. *Seminar Nasional Teknologi Informasi 2007*, *SNATI*, I-13-I–17.

Aqel, M. (2013). The effect of different interaction levels on instructional design learners. *Procedia - Social and Behavioral Sciences*, *103*(2004), 1035–1043. https://doi.org/10.1016/j.sbspro.2013.10.429

Creswell, J. W. (2014). *Research design: qualitative,quantitative,and mixed methods approaches* (4th ed.). SAGE Publications.

Dittrich, W., Drosd, R., Minkin, L., & Shapovalov, A. S. (2016). The law of entropy increase – A lab experiment. *The Physics Teacher*, *54*(6), 348–350. https://doi.org/10.1119/1.4961176

Djamarah, S. B. (2010). *Guru dan anak didik dalam interaksi edukatif; suatu pendekatan teoritis psikologis[Teachers and students in educational interactions; a psychological theoretical approach]*. PT.Rineka Cipta.

Erkens, M., Bodemer, D., & Hoppe, H. U. (2016). Improving collaborative learning in the classroom : Text mining based grouping and representing. *International Journal of Computer-Supported Collaborative Learning*. https://doi.org/10.1007/s11412-016-9243-5

Gandhi, P. R., Livezey, J. A., Zaniewski, A. M., Reinholz, D. L., & Dounas-Frazer, D. R. (2016). Attending to experimental physics practices and lifelong learning skills in an introductory laboratory course. *American Journal of Physics*, *84*(9), 696–703. https://doi.org/10.1119/1.4955147

Gillies, R. (2004). The effects of cooperative learning on junior high school students during small group learning related papers learning. *The Effects of Cooperative Learning on Junior High School Students during Small Group Learning*, *14*(0), 197–213. https://doi.org/10.1016/S0959-4752(03)00068-9

Gillies, R. M., & Boyle, M. (2010). Teachers' reflections on cooperative learning: Issues of implementation. *Teaching and Teacher Education*, *26*(4), 933–940. https://doi.org/10.1016/j.tate.2009.10.034

Hatch, E., & Farhady, H. (1981). *Research_design_and_statistics_for_appli.pdf*. Rahnama Publications.

Jones, J. A., D'Addario, A. J., Rojec, B. L., Milione, G., & Galvez, E. J. (2016). The Poincaré-sphere approach to polarization: Formalism and new labs with Poincaré beams. *American Journal of Physics*, *84*(11), 822–835.

Le, H., Janssen, J., & Wubbels, T. (2017). Collaborative learning practices : teacher and student perceived obstacles to effective student collaboration Collaborative learning practices : teacher and student. *Cambridge Journal of Education ISSN:*, *3577*(January). https://doi.org/10.1080/0305764X.2016.1259389

Lie, A. (2010). *Cooperative learning :practicing cooperative cearning in classrooms*. Gramedia Widiasarana Indonesia.

Miles, M. B., Huberman, M. a, Saldana, J., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3rd ed.). SAGE Publications. https://doi.org/January 11, 2016

Muuro, M. E., Oboko, R., & Wagacha, W. P. (2016). Evaluation of intelligent grouping based on learners ' collaboration competence level in online collaborative learning environment. *IRRODL*, *17*(2), 40–64.

Nurdiyanto, H., Surjono, H. D., & Fitrihana, N. (2018). Collaborative learning model with computer supported learning approach. *Advances in Intelligent System Research*, *144*(0), 225–228.

Pérez-Escoda, A., & Rodríguez-Conde, M. J. (2015). Digital literacy and digital competences in the educational evaluation. *Proceedings of the 3rd International Conference on Technological Ecosystems for Enhancing Multiculturality - TEEM '15*, *November*, 355–360. https://doi.org/10.1145/2808580.2808633

Pollock, P. H., Hamann, K., & Wilson, B. M. (2011). Learning through discussions: Comparing the benefits of small-group and large-class settings. *Journal of Political Science Education*, *7*(1), 48–64. https://doi.org/10.1080/15512169.2011.539913

Ramanda, P., & Khairat, I. (2017). Perbedaan kematangan sosial siswa yang berasal dari sekolah homogen dan sekolah heterogen. *Jurnal Kajian Bimbingan Dan Konseling*, *2*(4), 148–156.

Riswanto, & Noviayu, K. D. (2017). Peningkatan keterampilan proses sains melalui pembelajaran berbasis laboratorium untuk mewujudkan pembelajaran berkarakter[Improving science process skills through laboratory-based learning to realize character learning]. *Jurnal Riset Dan Kajian Pendidikan Fisika*, *4*(2), 60–65.

Sanjaya, W. (2006). *Strategi pembelajaran berorientasi standar proses pendidikan[Standard-oriented learning strategies of the educational process]*. Kencana Prenada Media.

Suh, H. J., & Lee, S. W. (2006). Collaborative learning agent for promoting group interaction. *ETRI Journal*, *28*(4), 461–474. https://doi.org/10.4218/etrij.06.0105.0235

Suseno, N. & Harjati, P. (2016). Experiment role to develop metacognition ability of prospective teachers. *The First International Conferences of Law, Education and Economics. 12 – 13 November 2016*, 1–15.

Suseno, N. (2012). Peran praktikum dalam mengembangkan kemampuan dan karakter mahasiswa calon guru fisika. *Prosiding Seminar Nasional Ke-1 UM Metro 2012*, 132–139.

Suseno, N., & Riswanto. (2017). Developing collaborative habits of prospective teachers. *The 8th International Conferences of Lesson Study. 14 – 16 September 2017*.

Whatley, J., & Bell, F. (2003). Discussion across borders: Benefits for collaborative learning. *Educational Media International*, *40*(1–2), 139–152. https://doi.org/10.1080/0952398032000092189

Wicaksono, S. R. (2015). *Computer Supported Collaborative Learning Berbasis Blog*. Seribu Bintang.

Wulannita, A. (2013). *Pengaruh dari implementasi tipe pengelompokan untuk meningkatkan hasil belajar dan interaksi siswa pada topik lingkungan pada siswa sekolah menengah pertama[The effect of implementing the type of grouping to improve learning outcomes and student interacti*. http://repository.upi.edu/2343/

Xiang, W., & Jing, X. (2020). Research on grouping strategies of online collaborative learning based on empathy. *ICETM*, *0*(0), 17–19. https://doi.org/10.1145/3446590.3446591

Zhan, Z., Fong, P. S. W., Mei, H., & Liang, T. (2015). Computers in human behavior Effects of gender grouping on students ' group performance , individual achievements and attitudes in computer-supported collaborative learning. *COMPUTERS IN HUMAN BEHAVIOR*, *48*(0), 587–596. https://doi.org/10.1016/j.chb.2015.02.038