The experimentation of LC7E learning model on the linear program material in terms of interpersonal intelligence on Wonogiri vocational school students

Antinah*, T A Kusmayadi and B Husodo
Graduate Program of Mathematics Education, Teacher Training and Education Faculty, Sebelas Maret University, Indonesia

*Corresponding author’s email: ragil_yess@yahoo.com

Abstract. This study aims to determine the effect of learning model on student achievement in terms of interpersonal intelligence. The compared learning models are LC7E and Direct learning model. This type of research is a quasi-experimental with 2x3 factorial design. The population in this study is a Grade XI student of Wonogiri Vocational Schools. The sample selection had done by stratified cluster random sampling. Data collection technique used questionnaires, documentation and tests. The data analysis technique used two different unequal cell variance analysis which previously conducted prerequisite analysis for balance test, normality test and homogeneity test. The conclusions of this research are: 1) student learning achievement of mathematics given by LC7E learning model is better when compared with direct learning; 2) Mathematics learning achievement of students who have a high level of interpersonal intelligence is better than students with interpersonal intelligence in medium and low level. Students’ mathematics learning achievement with interpersonal level of intelligence is better than those with low interpersonal intelligence on linear programming; 3) LC7E learning model resulted better on mathematics learning achievement compared with direct learning model for each category of students’ interpersonal intelligence level on linear program material.

1. Introduction
Learning is one form of education in order to improve the quality of self through his experience with the environment. Slameto [1] states that learning is a process that a person attempt to acquire a new behavior changes as a whole, as a result of his own experience in interaction with the environment. Therefore, through the learning process, the potential learners can be optimized to produce quality human resources. One objective of the learning process is to improve student achievement. According to Ayele [2], "Achievement is the success rate of students in achieving the goals set in the program." However, the achievement of which is generated by an education would be different between the students and other students even though these students are in an educational institution that is the same, and schooled by the same teacher.

Linear program is a mathematical model used to solve the problem of limited resources allocation in an optimal way [3]. The linear program involves planning the activities to be performed using linear relationship assumptions to achieve maximum results [4]. The subject of this linear program presents many challenging issues to solve and the form of questions is not routine. But the students sometimes
complain about the process of solving linear program problems, they assume quite complicated with the problems that are convoluted and require a long time [5]. Based on the result of National Examination (UN) in 2015, the students’ absorption in linear program material mainly determines the optimum value is still very low for Wonogiri regency, the material absorption is only 35.59%, the level of the province is 41.80% and the national rate is 38.72%. This indicates that the student is still difficult to understand and solve the problem related to linear program material. Therefore it is necessary to evaluate and update in learning to overcome the problem.

The learning model used is expected to be implemented in interactive, inspiring, fun, challenging, motivating students to actively participate and provide enough space for innovation, creativity, and independence according to their talents and interests of students [6]. One of the learning models that implement constructivist understanding is the learning cycle model (learning cycle) [7]. Cycle learning is an inquiry-based learning pattern, in which learners are more actively conducting scientific investigations through science skills to gain knowledge and experience [8]. The LC7E model occurs at certain stages, Engage stage becomes elicit and engage while elaborate and evaluate into three stages, namely elaborate, evaluate, and extend, so that the stages in LC7E are elicit, engage, explore, explain, elaborate, extend and evaluate.

Applying the Problem Base Learning (PBL) learning model and the model 7E Learning Cycle (LC7E) to determine the effectiveness and integrity of the learning outcomes seen from the ability of self-regulation and creativity of the students on the material system functions [9]. This study also stated that the learning model can LC7E complete lack of the PBL learning model, so as to improve student achievement, especially on the material system functions. Other research related to the application of learning models LC7E performed by Ates, et al.[10]. In his research, want to know the GI and NHT learning models in LC7E towards mathematics achievement and achievement motivation in terms of adversity quotient. In this study, learning model NHT in LC7E further enhance the learning achievement of the GI learning model in LC7E.

LC7E in the process of learning, the teacher only give an overall evaluation at the end of the lesson that not all students experiencing difficulties can be identified and addressed immediately [11]. At this stage of the just concluded evaluation overall teacher about what the subject matter and gives students the exercises without giving feedback on the student's work. Because of this learning process through several phases and the student should be able through it well, it is important for teachers to be able to know the extent to which students' understanding.

Maraichelvi [12] showed other factors that affect the low mathematics learning achievement, namely interpersonal intelligence. Interpersonal intelligence has a contribution of 36% towards student learning outcomes [13]. High interpersonal intelligence enables people to work with others and synergize to produce positive results [14]. It is enough to prove that the success of student learning is influenced by interpersonal intelligence [15]. With the development of interpersonal intelligence as early as possible to shape the character of students and instill positive values in him such as working together, independent and lateral thinking, a great sense of empathy and have a positive concept on others [16]. The purpose of this study are: 1) Which learning model that provides better learning achievement of mathematics between LC7E learning model and direct learning; 2) To know which have a better learning achievement between students with high, medium and low interpersonal intelligence; 3) To know in each category of students' interpersonal intelligence, which gives better learning achievement of mathematics, between LC7E learning model and direct learning.

2. Methods
This study is a quasi-experimental research. The independent variable in this study is a learning model, while the dependent variable is mathematics achievement. The populations in this study were students of Wonogiri Vocational Schools with a grade XI student research subjects in the first semester of the school year 2016/2017.

The methods that used to collect data in this study are two kinds, namely the method of documentation and test method. The instrument used to collect data is a mathematics learning
achievement test. Data analysis technique used in this research is analysis of variance of two ways different cell. Before performing the analysis conducted prerequisite test that is normality test and homogeneity test. In this research, for normality test used Illiefors method and homogeneity test using Bartlett test.

3. Result And Discussion

3.1. Result

Hypothesis test is using analysis of variance one way with different cells. Hypothesis testing done after the data is qualified test for normality and homogeneity tests with significance level of 5%. The following summary data normality test of mathematics learning achievement is using Lilliefors methods.

| Class         | $L_{obs}$ | $L_{table}$ | Test Decision | Conclusion     |
|---------------|-----------|-------------|---------------|----------------|
| LC7E          | 0.0779    | 0.0886      | $H_0$ accepted | Normal Population |
| Direct Learning | 0.0779    | 0.0865      | $H_0$ accepted | Normal Population |
| KI High       | 0.0813    | 0.1074      | $H_0$ accepted | Normal Population |
| KI Medium     | 0.0709    | 0.1003      | $H_0$ accepted | Normal Population |
| KI Low        | 0.1114    | 0.1206      | $H_0$ accepted | Normal Population |

Based on the data in Table 1 shows that all data comes from a normal distribute populations. Following is a summary of learning achievement data homogeneity test using Bartlett test.

| Homogeneity Test | $\chi^2_{obs}$ | $\chi^2_{0.05;k-1}$ | Decision | Conclusion |
|------------------|-----------------|----------------------|----------|------------|
| Learning Model   | 4.0694          | 5.991                | $H_0$ accepted | Homogene |
| Interpersonal Intelligence | 0.8036 | 5.991            | $H_0$ accepted | Homogene |

Based on data in Table 2 shows that all data comes from population that having homogeneous variance. Here's a summary of hypothesis testing using one way analysis of variance with different cells.

| Source | JK     | Dk   | RK    | $F_{obs}$ | $F_a$ | Decision |
|--------|--------|------|-------|-----------|-------|----------|
| Model  | 940,2631 | 1    | 940,2631 | 7,3579 | 3.8886 | Rejected |
| KI     | 2359,6638 | 2    | 1179,831 | 9,2327 | 3.0413 | Rejected |
| Interaction | 466,1270 | 3    | 233,0635 | 1,8238 | 3.0413 | Accepted |
| Error  | 25429,99 | 199  | 127,7889 | -       | -      |         |
| Total  | 29196,05 | 204  | -     | -        | -      |         |

Based on Table 3. Can be summarized as follows: 1) $H_A$ rejected, it shows that there is difference effect of learning model to student's mathematics learning achievement; 2) $H_B$ rejected, it shows that there is effect of level of interpersonal intelligence to student's mathematics learning
achievement; 3) $H_0$AB accepted, it shows that there is no interaction between learning model and level of interpersonal intelligence to student's mathematics learning achievement.

Post-anaya inter row testing is not necessary. This is because the variables in the learning model there are only two models of learning LC7E and direct. So it can be concluded that the student learning achievement given LC7E learning model has a better achievement when compared to the direct model of learning given. This can be seen from Table 4.

Table 4. The Average of Learning Model

| Learning Model | Interpersonal Inteligence | Average Marginal |
|----------------|---------------------------|------------------|
|                | High  | Medium | Low  |                 |
| LC7E           | 67,1563 | 62,9756 | 57,5185 | 67,1563         |
| KONTROL        | 63,1389 | 54,7143 | 56,7407 | 63,1389         |
| Marginal Average | 65,0294 | 58,7952 | 57,1296 | 65,0294         |

Comparisons between columns were performed to determine the effect of students' interpersonal intelligence on mathematics learning achievement presented in Table 5.

Table 5. Summary Comparison inter-collums

| Comparison | $F_{\text{obs}}$ | $F_{\text{table}}$ | Result |
|------------|------------------|---------------------|--------|
| $\mu_1 = \mu_2$ | 62,1472 | 6 | Rejected |
| $\mu_2 = \mu_3$ | 14,5897 | 6 | Rejected |
| $\mu_1 = \mu_3$ | 144,5599 | 6 | Rejected |

While $H_0$AB is accepted then there is no need to test double comparison inter-cells on the same column and row.

3.2. Discussion

Based on the results of statistical hypothesis test that has been described above can be explained to four research hypothesis as follows:

3.2.1. First Hypothesis. Based on the results of the research data analysis concluded that there are differences in mathematics learning achievement of students who were given learning using LC7E learning model with direct learning. By taking into account the marginal rate, it can be concluded that the mathematics learning achievement of students who were given learning using the LC7E learning model resulted in better mathematics learning achievement compared with the students who were taught using the direct model.

The results of the study in accordance with the research of Ignacio, et al [17] which states learning cycle model is a model of student-centered learning that adopts the principle of constructivism. Learning cycle is a series of stages of activities (phase) is organized in such way, so that students can master the competencies that must be achieved in learning with the active role [18]. The learning model of learning cycle developed from Piaget's theory of cognitive development. This learning model suggests that the learning process can involve students in active learning activities so that the process of assimilation, accommodation and organization in the cognitive structure of students achieved [19]. If there is a knowledge construction process with both the students will be able to improve their understanding of the material being studied.

3.2.2. Second Hypothesis. Based on the results of data analysis concluded that there are differences in mathematics learning achievement of students who have high intelligence, moderate and low. By paying attention to the marginal rate, it can be concluded that the mathematics learning achievement of
students who have a high level of interpersonal intelligence is better than students with interpersonal intelligence level is and low. Students' mathematics learning achievement with interpersonal intelligence level is better than those with low interpersonal intelligence level.

The results of this study in accordance with the research that high interpersonal intelligence makes people can work with other people and do the synergy to produce positive results [20]. Strong interpersonal intelligence for success, on the contrary, weak interpersonal intelligence will confront us with our constant frustrations and failures and success, if any, happen by chance [21].

3.2.3. Third Hypothesis. Based on the analysis of research data concluded that H0AB accepted means there is no interaction between learning model and the level of students' interpersonal intelligence on mathematics learning achievement on linear program material. Based on the results of the first hypothesis test, the learning model using the LC7E model resulted in better mathematics learning achievement compared to the direct learning model. The results of this study in accordance with the research of Biber et al [22] Since there is no interaction then it also applies equally to each category of students' interpersonal intelligence.

4. Conclusion
Based on the results of research and discussion in this study, obtained the conclusion that: 1) Mathematics learning achievement of students given LC7E learning model is better when compared with direct learning; 2) Mathematics learning achievement of students who have a high level of interpersonal intelligence is better than students with interpersonal intelligence level medium and low. Students' mathematics learning achievement with interpersonal intelligence level is better than those with low interpersonal level of intelligence on linear programming; 3) LC7E learning model resulted better mathematics learning achievement compared with direct learning model for each category of students' interpersonal intelligence level on linear program material. Suggestions from the results of this study are: 1) The use of LC7E learning model adapted to the material to be taught; 2) This research should be continued with broader research. In this study, the LC7E learning model is studied only on linear program material, so that research can be done with different materials.

5. References
[1] Slameto 2010 Belajar dan Faktor-Faktor yang Mempengaruhiya (Jakarta: Kencana Prenada Media Group)
[2] Ayele M A 2016 Mathematics Teachers’ Perceptions on Enhancing Students’ Creativity in Mathematics Dalam IEJME—Mathematics Education 3521-3536
[3] Fang Q and Zhu S 2002 Linear and Integer Programming Techniques for Cooperative Games. International Journal of Foundations of Computer Science 13 05 653-666
[4] Nasrun 2016 IOSR J of Math (IOSR-JM) 12 113
[5] Reich D 2013 J of Oper Res 230 487
[6] Cankoy O and Darbaz S 2010 Effect of a problem posing based problem solving instruction on understanding problem Hacettepe University Journal of Education 38 11-24
[7] Firdaus F, Priatna N and Suhendra S 2017 An implementation of 7E Learning Cycle Model to Improve Student Self-esteem Journal of Physics: Conference Series 895 1 012084
[8] Jati N H D and Slamet I 2017 Students’ Mathematical Communication Ability using Learning Cycle 7E on Junior High School Journal of Physics: Conference Series 895 1 012040
[9] Sag G Y and Akdogan E E 2016 Australian J. of Teac. Educ 41 12
[10] Ates S, Baysal I and Golkay B 2005 J. of Sci. Edu 9 1
[11] Qarareh A O 2012 The Effect of using the learning cycle method in teaching science on the educational achievement of the sixth graders International Journal of Educational Sciences 4 2 123-132
[12] Maraichelvi A and Rayan S 2013 Uni. J. of Psy. 1 2 010203.
[13] Gupta M, Jain M and Pasrija P 2014 Gender related effects of co-operative learning strategies (STAD and TAI) on mathematics achievement Issues and Ideas *Educ. J* 2 53
[14] Lwin M, Khoo A, Lyen K and Sim C 2008 *Cara Mengembangkan Berbagai Komponen Kecerdasan* (Yogyakarta: Indeks)
[15] Gerhana M T C, Mardiana M and Pramudya I 2017 *J. Phys: Conf* 909 64
[16] Nwadinigwe L P and Obieke A U 2012 *J. of Emerg. Tren. in Edu. R. and Pol. Stud. JETERAPS* 3 4 395
[17] Ignacio N, Nieto L and Barona E 2006 *Elec. J. of Math. Edu.* 1 16.
[18] Khalid A and Azeem M 2012 *Int. J. of Hum. and Soc. Sci* 2 170
[19] Marleny L and Aloysius D C 2017 *J. Phys. Conf. Ser.* 795 71
[20] Siribunnam R and Tayraukham S 2009 Effects of 7-E, KWL and conventional instruction on analytical thinking, learning achievement and attitudes toward chemistry learning *Journal of Social Sciences* 5 4 279-282
[21] Poliyem T, Nuangchalerm P and Wongchantra P 2011 *Aust. J. of Bas. and Apl. Sci* 5 257.
[22] Biber Ç, Tuna A and Korkmaz S 2013 The Mistakes and the Misconceptions of the Eighth Grade Students on the Subject of Angles *European Journal of science and mathematics education* 1 2 50-59