International Journal of Evaluation and Research in Education (IJERE)
Vol.3, No.4, December 2014, pp. 236~244
ISSN: 2252-8822

Problem Based Learning in Cooperative Situation (PBLCS) and Its Impact on Development of Personal Intelligence

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Article Info

Article history:

Received Nov 5, 2014
Revised Nov 21, 2014
Accepted Nov 28, 2014

Keyword:

Interpersonal intelligence
PBLCS learning model
Personal intelligence
Problem based learning

ABSTRACT

The objective of this study was focused on the observation on the practice of PBLCS learning model, and its impact on the development of personal intelligence (interpersonal and intrapersonal) students. This study used a quasi-experimental design with one factor measurement. The study population was students of class XI, IPA (Natural Science) SMAN (Senior High School) 22 in Makassar City, including 6 top schools and 16 regular schools, in the second semester in the period 2012/2013. The sample of this study included both one top school and two regular schools using a random sampling technique. Based on the sample selection technique, two classes were selected from the top school; SMAN 1 and two classes from regular classes; SMAN 4, and SMAN 18, involving 103 students for PBLCS and 103 students for PT (traditional class). Data of this study were analyzed inferentially and descriptively, inferential analysis using multivariate statistic and a multivariate analysis using variance or one-way MANOVA. The results of this study showed that the implementation of PBLCS model (treated class) was better than the PT strategy (controlled class) in developing personal intelligence of students, with the significance $0.000 < \alpha = 0.05$. It was supported by descriptive data indicating that the mean score of personal intelligence development. Both interpersonal and intrapersonal intelligence of students in the treated class was higher than the development of interpersonal or intrapersonal intelligence students in the controlled class.

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1. INTRODUCTION

The There are many factors that can be identified and associated with poor student achievement in mathematics, either in intelligence or cognitive aspects of personal (personality). In terms of the nature of intelligence, education in high school fails to create a positive character, this phenomenon can be seen from the behavior of students indicating phenomenon of decline and moral decay such as sex, drugs, bullying, fights among students, going on strike brutally, students involved in the culture of hitting others and other criminal activity [1],[2]. One factor causing the failure to use learning method that is not focused on developing a personal intelligence. This learning method is appropriate suitable learning method involving all students, whether this ability to think or work together as a team to solve the problem [3]. Traditional learning methods (CB) are still practiced by teachers in secondary schools, with this method the teacher is simply to share some insights into the minds of the students without identifying whether or not the concept described still remain in the minds of the students. To obtain knowledge or mathematical concepts clearly,

learners should make active and continuous efforts. [4]-[7]. Students themselves are expected to increase their knowledge using various methods and cognitive strategies during their learning process.

The model of problem-based learning in a cooperative situation (PBLCS), is one of the learning methods that can be applied to make the students active. With this model, the teacher gives the problem to the students, which can help students to achieve a higher level of understanding, then teachers guide students to solve the problem, either as individual or as a team [8],[9]. This is an effective method that can enhance multiple intelligences [10],[11]. The problem-based learning is focused on problems in which students can construct their own knowledge, develop inquiry and thinking skills to a higher level [12]. Students should be able to formulate a temporary answer to a problem requiring logical intelligence, courage and active solution with in real situation. Students also need to improve their independence, self-confidence and endurance to solve the problem. Such situation provides an opportunity for students to do a research and build a social relationship in a cooperative team work [13],[14]. In addition, students have the opportunity to develop interpersonal intelligence to understand each other, interact, share experiences and get understanding among members of the group about the problems that will be solved. Students also develop their own intrapersonal intelligence to bravely communicate their ideas and express what he thinks.

This study applied the problem-based learning model in a cooperative situation (PBLCS), and used the appropriate modules PBLCS. The model was expected to improve the quality of the learning process as well as to make students easy in the process of learning to master mathematics lesson syllabus, particularly under the topic of differential function. The PBLCS model encourages students to actively participate, i.e. they will build and engage in the learning process, the PBLCS model also involves problem-based learning model and the cooperative learning model, as one of student-centered learning methods. This model will help develop the multiple intelligences, in the affective aspect can increase motivation, independence, self-confidence, assertive and positive interest attitude, as well as improve the students' cooperative and social relationships ability [14]-[16]. This activity clearly can encourage the development of interpersonal and intrapersonal intelligences of students. Thus, efforts to develop multiple intelligences in the learning process in math class, is an important thing of the innovative learning model that will improve the quality of mathematics learning process in the senior high schools. This learning model is considered to be able to enhance multiple intelligences, especially interpersonal and intrapersonal intelligences students [17],[18]. The impact of this model will produce students who do not only have cognitive intelligence, but also affective intelligence domain [19]-[21].

1.1. Problem Based Learning in Cooperative Situation (PBLCS)

Constructivism was born from the idea of Piaget and Vygotsky, in which both of them emphasizing that cognitive changes only occur if the conceptions that previously had been understood were managed through a the imbalance (disequilibrium) process in order to understand the new information. A broader idea of Piaget [22] on the development of cognitive structures, describes the scheme as a mental structure of a person which is intellectually adapted to its environment. Scheme is a process in a person's realization system which always adapts and changes during cognitive development. Furthermore, Piaget explains the cognitive processes of assimilation, accommodation, equilibrium, and disequilibrium, in which the cognitive processes are closely interrelated in the cognitive development of the learning process according to the constructivist theory [23].

Constructivist learning can help students to internalize and modify the new information, so that the transformation takes place to produce new knowledge that in turn will construct new cognitive structures. According Vigotsky [6],[24] that in the constructivism, the teacher's role is not a final answer provider to students' questions, but to guide them to organize and construct knowledge until they acquire concepts, so that the students can find their answer. Other principles of the theory is Vigotsky, the students will learn the best concepts when concepts are in their immediate development zone (ZPD). [25] he explained that the ZPD is a zone of cognitive development, in which students are in this zone, found it difficult to solve their own problem, but they can manage well when they got support from others who are in more advanced development. The teachers' position in the learning mathematics is to discuss and consult with students, or instruct students to discuss with other students in the group learning, they are not in position to give the available final answer. The meaning of discussion and negotiation in this case is to make a routine problem, or to give a problem in the form of questions that challenge students to think more and to discuss and negotiate further to solve the problems. This kind of learning practices are relevant to the features of problem-based learning model in a cooperative situation (PBLCS).

Problem-based learning model, was also found in the theory of democratic class of John Dewey [26], describing that an opinion about education in schools should reflect a larger community. Dewey focused on teachers to encourage students to participate in projects or assignments in the form of problems and mutually help each other, or to solve a problem based on a teacher's guide. The main implication of

democratic class theory on PBLCS models, is expected to be a school lab or problem solving place involving a real life, and the best place to start intellectual cooperative work in groups together in groups to solve problems.

Based on the theoretical study presented above, it can be concluded that the PBLCS learning model is oriented to engage or activate students to solve problems in groups. The learning process does not expect students to just listen to, record, and then memorize the lesson content, but they should actively think, communicate with friends and use all the potential they have to express thoughts as widely as possible in the learning so that they can build meaningful knowledge, both personally and in a team. According Vigotsky [27],[28] this method will be more likely to occur when students are accompanied by a person who has higher knowledge, for example, a friend who is more proficient or a teacher as a facilitator who can help step by step in the learning process, they can provide assistance when needed. This is in line with the characteristics of cooperative learning in which the learning is undertaken through a collaborative team, with the goal of humanistic theory, in which the learning process begins from the interaction among students, the interaction between students and teachers, the aim of this method is to humanize human. Thus, the theory of this study is not only appropriate, but also very supportive to the purpose and characteristics of the PBLCS learning.

1.2. Multiple Intelligences

According to [29], the multiple intelligences can changeable and dynamic. The multiple intelligences development does not not occur incidentally or immediately, but requires time and processes in the form of multiple intelligences. School environment, particularly activities in the learning process in math class is potentially implemented multiple intelligences. Intelligence potential of students can grow in a positive way, when teachers include elements or positive activities in the learning models that can develop multiple intelligences. The theory of multiple intelligences believes that a person's intelligence can be developed through learning activities [29],[10]. This theory supports the learning focused on student, i.e. the learning that focuses on problem solving and cooperative work, because with such learning activities, the students will experience the true real learning process in the classroom, so it can give a profound impact on the learning of mathematics. If the senior high schools intend to develop multiple intelligences, then applying the PBLCS model in mathematics learning process, is the appropriate step [15]. Mathematic teachers need to be wise and active in playing a role in selecting and using appropriate learning model in the classroom, teachers are encouraged to take initiatives to adopt the learning models that can develop interpersonal and intrapersonal intelligences of students [17],[10],[11]. Also teachers also need to leave the traditional strategies implemented, which do not only fail to improve academic achievement, but do not develop multiple intelligences of learners.

1.3. Personal Intelligences

Intelligence Psychologists experts mention and confirm the existence of interpersonal intelligences as part of the multiple intelligence i.e. [29], If Thorndike [30] refers it as social intelligence, this means that children who have interpersonal intelligence will be able to establish social relationships with other people, be able to establish communication, be able to express empathy well, and be able to develop a harmonic relationship with other social environments. They will be able to understand quickly temperament, character and personality of others, to understand the moods, motives and intentions of others. All these efforts will encourage them more successful in interacting with their social environment.

If the intrapersonal intelligence is a part of multiple intelligences stated by Gardner, intrapersonal intelligence can be broadly defined as intelligence belonging to the individual enabling to understand themselves. If it is defined in the narrow sense, it is the ability of individuals to know and identify emotions, as well as know the weaknesses within themselves, so that they can motivate themselves. [31] states that basically every person has been awarded intrapersonal intelligence, but the degree varies, and usually the person who has the characteristics of intrapersonal intelligence will manifest themselves as someone who feels comfortable to themselves, satisfied and have positive thinking because what they do based on their own real ability. In this context, it can also be argued that intrapersonal intelligence is the ability to identify themselves, so they will have a clear and positive concept as well as self-image [29].

Effects of PBLCS model toward personal intelligence can occur, as supported by [32] and [10], who describes that the multiple intelligences can be developed, this study learned that using PBLCS model, which is also supported by a learning theory of Piaget, Vigotsky, Bruner, Dewey, Ausubel, Hubermas and Maslow, so the use of PBLCS model with the activity learning phases, that can help students to manifest their best ability, so they may develop their team work skills in groups, also students can develop their interpersonal intelligence, and increase independence and self-confidence and are not easily frustrated, or students can develop their intrapersonal intelligence.

2. RESEARCH METHOD

This study used a quasi-experimental methods (quasi experiment research), not the actual experimental studies, because the selected sample were available classes. Students of the class were selected by the senior high school parties in Makassar City, the sample for treated class and controlled classes were difficult to or could not be selected at random [33]. Also in this study, the researcher can not control all the variables that are relevant, as has been explained before [34], as the situation of this study does not allow researchers to control or manipulate all relevant variables, the quasi-experimental studies can be applicable. Furthermore, he added that one of the purposes of quasi-experimental methods is to obtain information through the study of using actual experiment. The principal activities of this study is to develop a model for problem-based learning in a cooperative situation (PBLCS) and appropriate PBLCS module, and then implement the PBLCS model, which is controlled by traditional learning strategies (PT), to see the effect on the development of interpersonal intelligence and intelligence intrapersonal students, the three intelligences were called as the dependent variable. The independent variable in this study is the method of learning. Before starting the study, homogeneity sample test was done in advance, it aimed at determining whether the treated class and controlled classes in a homogeneous or not.

The study population was students of class XI IPA (Natural Science) SMAN (Senior High School) 22 in Makassar City, including 6 top schools and 16 regular schools, in the second semester in the period 2012/2013. The independent variable of this study was related to the application of PBLCS learning model, controlled by using traditional learning strategies (PT). The sample of this study included both one top school and two regular schools using a random sampling technique. Based on the sample selection technique, two classes were selected from the top school; SMAN 1 and two classes from regular classes; SMAN 4, and SMAN 18, involving 103 students for PBLCS and 103 students for traditional class. Thus, the total samples were 206. Dependent variables studied were related to personal intelligences, including interpersonal intelligence and intrapersonal intelligence students.

The data in this study were collected through questionnaires of interpersonal intelligence, and intrapersonal intelligence of students, student feedback, and academic achievement tests of math based on of differentiation of duplicate topics distributed to two groups, the treated group and the controlled group. Questionnaire of interpersonal intelligence and intrapersonal intelligence are in the form of Likert.

In order to meet the criteria of valid questionnaires, the first questionnaire content validity was examined by the validator, then calculated validity and reliability with software BUTPAD Multipoint Scale. The results obtained 27 item questionnaires with a valid interpersonal realibiliti 0913, and obtained a 29 item questionnaire with a valid intrapersonal reliability 0874.

The questionnaire of interpersonal intelligence was distributed to determine the level of students' interpersonal intelligence. The questionnaire was developed based on indicators or characteristics of interpersonal intelligence, namely (1) social sensitivity, (2) social vision, and (3) social communication. The questionnaire of intrapersonal intelligence was distributed to determine the level of students' intrapersonal intelligence. The questionnaire was developed based on indicators or characteristics of intrapersonal intelligence, this questionnaire consisted of three main components intrapersonal intelligence, namely (1) identify himself, (2) self-motivation, and (3) manage themselves.

The data of this study were analyzed inferentially and descriptively, by using inferential analysis of multivariate statistic analysis, a multivariate analysis of variance or MANOVA [35], [36], [9]. Descriptive analysis was used to describe the highest value, the lowest value, the mean, percentage, standard deviation and frequency distribution of interpersonal intelligence and intrapersonal intelligence of students. According to [18], the MANOVA analysis is used to test a hypothesis. Before testing the hypotheses, the assumptions need to be tested in advance according to several criteria, namely: (1) isolation (independence) of the values of observation, (2) homogeneity test using Levene's Test, and (3) normality of group data distribution examined using plots and Kolmogorov Smirnov-Test to see if the data is normally distributed data.

3. RESULTS AND ANALYSIS

3.1 Development of Personal Intelligence Based Learning Method

3.1.1 Development of Interpersonal Intelligence (KIER) in treated class (PBLCS) and controlled class (PT)

The treated class is was class with PBLCS learning model, and the controlled class was the class with the traditional learning strategies (PT). Table 1 presents the statistical development of KIER intelligence of the two groups of students.

Table 1. Statistical data development of interpersonal intelligence (KIER) in treated class (R) and controlled class (K)

Statistic	KIER (Interpersonal)	
	R	K
N	103	103
Mean	9.10	0.61
Median	8.00	0.00
Dev. Standart	5.43	3.86
Minimum	-2	-12
Maximum	30	13

Interpersonal intelligence questionnaire used a questionnaire containing 27 items. The instrument was distributed to determine the level of students' interpersonal intelligence. Looking at the mean score results of the two classes as shown in Table 1, that is the mean score development of treated class i.e. 9.10 and the controlled class i.e. 0.61, then it shows that the mean score development of KIER students at treated class is higher than the mean score development of KIER at controlled class.

If observed the more detailed of score findings for each indicator (aspects of intelligence), it was found that the mean score development of treated class was higher than the mean score the controlled class students, showing that mean score development indicator of social sensitivity is the highest scores i.e. 0.44, and social communication indicator was 0.24 as the lowest mean scores.

3.1.2 The development of intrapersonal intelligence (KIRA) in treated class (PBLCS) and controlled class (PT)

Table below presents the statistical development of KIRA intelligence of the two groups of students.

Table 2. Statistical data development of intrapersonal intelligence (KIRA) in treated class (R) and controlled class (K)

Statistic	KIRA (Intrapersonal)	
	R	K
N	103	103
Mean	9.21	0.28
Median	8.00	0.00
Dev. Standart	9.13	4.00
Minimum	-7	-14
Maximum	34	11

Questionnaire of intrapersonal intelligence involves a questionnaire containing 29 items. The instrument was distributed to determine the level of students' intrapersonal intelligence. If results mean scores results of the two classes as shown in Table 2, i.e. the mean score development of KIRA treated class i.e 9.21 and mean score development of controlled class i.e. 0.28, then it showed that the mean score development of KIRA students at treated class is higher than mean score development of KIRA students at controlled class.

If we looked the findings more details for each indicator (aspects of intelligence), then it was found that the mean score development of KIRA students in the treated class was higher than the mean scores development for each indicator of KIRA. If the mean score for each indicator was observed in treated class, it showed that the mean score of development indicators to know themselves was the highest mean score i.e. 12.33, and indicators of self-management is 0.29 as the lowest scores.

3.2 Personal Intelligence Development According to School Level

3.2.1 The Development of Interpersonal Intelligence (KIER) on Both Top School and Regular School Level

Both students who were accepted at top level schools and students who were accepted at the regular school determined based on particular criteria set by the Education Committee of Makassar City. Table below presents the statistical intelligence development of KIER students at both school levels.

Table 3. Statistical data development of intelligence KIER at both top school (SU) and regular school (SB)

Statistic	KIER (Interpersonal)	
	SU	SB
N	70	136
Mean	4.51	5.03
Median	3.00	3.50
Dev. Standart	6.51	6.26
Minimum	-12	-6
Maximum	19	30

Looking at the mean score findings at both the school level as shown in Table 3, it was concluded that the mean score for KIER students of top level i.e. 4.51 and the mean score of students in the regular school i.e. 5.03, this means that the mean score of interpersonal intelligence of regular school level students was higher than top level school students.

3.2.2 The Development of Intrapersonal Intelligence (KIRA) on Both Top School and Regular School Level

Table below presents the statistical development of KIRA students' intelligence of both school level.

Table 4. Statistical data development of intelligence KIRA at both top school (SU) and regular school (SB)

Statistic	KIRA (Intrapersonal)	
	SU	SB
N	70	136
Mean	8.36	2.89
Median	4.50	2.00
Dev. Standart	11.50	5.26
Minimum	-14	-7
Maximum	34	29

If the mean scores findings of both school levels were observed, the Table 4 showed that the mean scores of KIRA school students in the top school level i.e. 8.36 and the mean score of regular school students level i.e. 2.89. This means that the mean score of intrapersonal intelligence at top school student was higher than the mean scores of regular school students.

3.3 Effects of Learning Method

This study involved one factor (independent variable), 2 responses (dependent variable), and 206 students from three senior high schools on as study samples. The factor was the learning method, having two levels, the PBLCS learning model and the traditional learning strategies. There were two types of testing hypothesis was performed simultaneously using one-way MANOVA, they gave impact factors on the two dependent variables were observed, namely: (1) interpersonal intelligence, and (2) intrapersonal intelligence. Testing performed at significance level 0.05.

3.3.1 Testing Requirements Analysis MANOVA

Before testing the hypothesis with MANOVA, the hypothesis need to be revised in advance with some requirements namely: (1) isolation (independence) of the observation values, (2) homogeneity test using Levene's Test, and (3) normality test of data distribution of the data group investigated using Kolmogorov-Smirnov Test to see if the multivariate distributed data were normal or not. The calculation was done using SPSS version 20.

The first assumption about the independence of observation values is guaranteed during the data collection process. Implementation of filling scales (questionnaire), was adapted and controlled so well, there

was no possibility to work together or exchange information among the selected students, or between groups of students. Thus, the value of each observation was granted independence.

The second assumptions about the similar matrix to two-mode various data were tested using Levene statistical test, using $\alpha = 0.05$ significance level. MANOVA assumes that each dependent variable had similar variance for all the groups. Levene's statistical test tested this assumption, for KIER variables with significance 0.027 and KIRA with significance 0.000 that is under 0.05, so the zero hypotheses stating the variance of homogenous matrix is rejected. This means that the variance of each dependent variable was different. This result was contrary to the assumption of MANOVA. However, the F test results robust, so the analysis could be preceded. This analysis remained strong (robust) and gave accurate results even if the variance is not homogeneous [37],[38].

The third assumption of data distribution normality of both responses observed was investigated by using the Kolmogorov-Smirnov Test to see whether or not the data were distributed with normal multivariate. Regarding to KIER variables with significance 0.194 and KIRA significance 0.056 are entirely above $\alpha = 0.05$ so normality test of data distribution of the two dependent variables were observed, showing that the data of each group meet normality distribution assumption. This means that the data in each group meets multi normal distribution assumptions. Because the use of MANOVA assumptions are met, then the testing hypotheses using MANOVA to test whether or not the existence of impacts of learning method on both responses observed can be carried out.

3.3.2 Testing Study Hypotheses

Based on the learning method factor, and the significance of each of the statistic test in the last column of Table 5 and by comparing the testing criteria at $\alpha = 0.05$, it was concluded that they were all below the significance level $\alpha = 0.05$, either using statistical tests of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, or Roy's Largest Root ($0.000 < \alpha = 0.05$), indicating that the data support the acceptance of hypothesis was that there was an impact factor of learning method toward the dependent variables observed, or could be said that the data support the acceptance of the hypothesis that there was an impact factor of the learning method on the increase of personal intelligence, namely the development of the interpersonal and intrapersonal intelligence of student, as shown in Table 6.

Table 5. Test impact of learning method

Factor	Test	Value	F	sig.
Method (Strategy)	*Pillai's Trace*	0.555	84.089[a]	0.000
	Wilks' Lambda	0.445	84.089[a]	0.000
	Hotelling's Trace	1.249	84.089[a]	0.000
	Roy's Largest Root	1.249	84.089[a]	0.000

Table 6. Test impact among dependent variables based learning method

Intelligences	df	Mean Square	F	sig.
KIER (Interpersonal)	1	2.788	198.686	0.000
KIRA (Intrapersonal)	1	2.491	99.406	0.000

Hypothesis one: The development level of students' interpersonal intelligence, using problem-based learning in a cooperative situation model was better than students using traditional learning strategies, with the significance $0.000 < \alpha = 0.05$.

The above hypothesis was supported by research data in Table 1, showing the mean scores of the treated class development i.e. 9.10 and a mean score of controlled class development i.e. 0.61 so the impact of the mean score of students in the KIER treated class development was higher than students in the KIER controlled class development, so the findings of this hypothesis means that with the significance level $\alpha = 0.05$, the development level of students' interpersonal intelligence obtained PBLCS learning model was better than students who obtained with traditional learning strategies.

Hypothesis two: The development level of students' intrapersonal intelligence, using of problem-based learning in a cooperative situation model was better than students using traditional learning strategies, with the significance $0.000 < \alpha = 0.05$.

The above hypothesis was supported by research data in Table 2, which showing the mean scores of development of treated class with the mean score 9.21 and the mean 0.28 of the controlled class, showing that the mean score of KIRA students in the treated class development was higher than KIRA students in the

controlled class development, the findings of this hypothesis indicated that with the significance level $\alpha = 0.05$, the development level of intrapersonal intelligence of students who obtained PBLCS learning model is better than students who obtain traditional learning strategies.

4. CONCLUSION

Based the data analysis, both inferential and descriptive implementation of the PBLCS learning model, and its impacts on the development of personal intelligence students, the study found that the students' interpersonal intelligence level using problem-based learning in a cooperative situation model was better than students who obtained traditional learning strategies. This was supported by descriptive data with the mean score of students' interpersonal intelligence in the treated class development was higher than the development of students' interpersonal intelligence in the controlled class.

Furthermore, the students' intrapersonal intelligence development level, using problem-based learning in a cooperative situation model was better than students using traditional learning strategies. It was supported by descriptive data showing that the mean score of intrapersonal intelligence students in the treated class development is higher than the development of intrapersonal intelligence students in the controlled class.

The descriptive data at the level schools shows that the mean score of interpersonal intelligence development in the regular schools was higher than the mean scores of students at the top school. But the development of students' intrapersonal intelligence in the top school was higher than students in regular schools level.

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