The Effectiveness of CPS-ALM Model in Enhancing Statistical Literacy Ability and Self Concept of Elementary School Student Teacher

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Abstract

The focus of this study is to examine comprehensively statistical literacy and self- concept enhancement of elementary school student teacher through CPS-BML model in which this enhancement is measured through N-gain. The result of study indicate that the use of Collaborative Problem Solving Model assisted by literacy media (CPS-ALM) model contribute to student's statistical literacy enhancement better than expository learning (EL). It is identified also that there is difference in student's self- concept enhancement between CPS-ALM group and EL group. CPS-ALM group achieve enhancement in medium category with N-gain average is 0.33, while EL group achieve enhancement in low category with N-gain is 0.16. One way which trigger enhancement of student's statistical literacy and self concept is the use collaborative mode. Indicators of statistical literacy and self concept are identified to experience enhancement when collaborating, in which students are demanded to have confidence toward statistic ability they have when delivering creative ideas. Exploration done by students toward self ability need a belief toward their ideas in Statistic Education course.

Keywords: Statistical literacy, Self concept, CPS-ALM Model, Elementary School Student Teacher

1. Introduction

In knowledge era today, statistics play important role in all human activities. Related with that role, thus from elementary school until higher education level, this field draw more attention in learning. Based on learning material content, it is inevitable that statistics has been viewed by many student as difficult and unpleasant lesson. This is because view toward the abstractness of learning material invoke anxiety which result in motivation and enjoyment in learning. This view as identified by Verhoeven (2006) that anxiety toward statistic result in interest in learning.

UNESCO (2004) which is quoted by Farmer and Stricevic (2011) revealed that literacy is ability to identify, understand, interpret, make, communicate, and count through sources obtained from various media and being able to write in various contexts. Understanding and comprehension of literacy are continually developed and applied in various fields, among others: literacy in information, media literacy, science literacy, mathematical literacy, and statistical literacy.

Garfield (1999) define statistical literacy as "The understanding of statistical language: words, symbols, and terms. Being able to interpret graphs and tables. Being able to read and make sense of statistics in news, media, polls, etc." Another view is suggested by Aoyama (20030 that statistical literacy is ability to extract qualitative information and quantitative information, and make new information from those qualitative and quantitative information.

There are two main components which should possessed by individual related with statistical literacy, namely: (1) ability to interpret and evaluate statistical information in various context; (2) ability and understanding to communicate (Gal 2002). Those two components have important role in helping individual to make decision statistically toward problem faced.

Researcher has a view that statistical literacy can be defined as ability in reading, writing, understanding, interpreting, analyzing and interpreting data through skill possessed, and capable in understanding and presenting information in the form of symbol, table and graphic contained in various media. In its application, many sources can be used as learning media of statistical literacy, among others: print media, electronic media, journal, book report, internet, and another various sources.

Phenomena which happened is, there is gap between the importance of statistics in daily activity and ability possessed by Elementary School student teacher. Result of study which was conducted by Takaria (2010) identified that student's statistic ability in one of Elementary School in Ambon City had not achieved maximal result. This indicate that student teacher should be equipped with statistical ability in order to be able to apply their knowledge later.

Identification of problem in statistics teaching had been done by some researches among others; Garfield (1995) identify that in statistics learning, student not empowered to apply statistics knowledge aspects to solve general problem aroused from certain context. Verhoeven (2006) identify that phobia toward mathematics and statistics anxiety result in interest to learn those two lessons. Garfield and Ahlgren

(Tishkovskaya & Lancaster, 2010) find the lack of basic statistics knowledge and Gal, 2002; Schield, 2004; Verhoeven, 2006 (Tishkovskaya & Lancaster, 2010) find the lack statistical literacy ability and students inability to use statistics in their daily life.

Based on evaluation which was done by researcher as lecturer of mathematics and statistics course in PGSD study program in one of LPTK in Maluku Province, Ambon City, it is identified that, there are some matters found which is continually need to be enhanced related with student's mathematical and statistical ability, among others: 1) counting ability and mathematical reasoning: 2) statistical ability, in this case related with ability to read table, graphic, statistic symbol; and 3) analysis and interpretation ability.

Elementary School student teachers sometimes feel that they are unable in statistics course, accomplish assignment given, interact with friends, and do not have ability in constructing ideas. This give influence to motivation, learning attitude, and self-concept of students in lecturing. According to Marsh (Githua and Mwangi, 2003) that view about self inability to achieve success and self confidence in learning indicate negative self concept, thus will effected on learning motivation and excessive anxiety before following learning. The such feeling signal there is judgment on limitation of self ability in lecturing.

Self-concept as revealed by Marsh, et al (Maurent & Margareth, 2012) is process to build multi-dimension which refer to individual perception from "self" in relation with some characteristics such as: physical performance, goal, values and self-esteem. This view indicate that self-concept is very influence in how students fell about themselves, about ability and decision they make related with their education.

Self-concept in lecturing formed through learning teaching interaction, in which lecturer can create atmosphere and student perception about his/her self-concept, both positive and negative self-concept. It is hoped that professional educators arise positive self-concept possessed by their students. For example, value their opinion, give opportunity to ask question, give praise with words that can motivate them to learn, and another actions which can form positive self-concept.

The forming of student's self-concept in lecturing can be established by using model and learning strategy which are cooperative, varied and innovative. This make students can interact, bring creative ideas, and argue, and can cooperate in group. All of these automatically can form student's self-concept.

Problem solving collaborative model is predicted capable to facilitate students in enhancing their statistical literacy ability and self-concept. According to Sato (Widjayanti, 2011) that collaborative learning is learning which is implemented in group, but the aim not to achieve unity acquired through group activity, but students in group is encouraged to find various opinions or thinking from each individual in group. Learning is not happened in unity, but learning is result of diversity or difference. Learning should "exceed boundary and jump" through collaboration.

This study aim to: 1) analyze comprehensively the difference in statistical literacy ability enhancement between students who are taught by problem solving collaborative model and who are taught by expository learning; 2) analyze student's statistical self- concept after CPS-ALM model is applied.

2. Concept of Literacy and Statistical Literacy

In English terminology, word "literacy" is very familiar with literary, in which since the end of 19th century the word literacy refer to an ability in reading and writing text while keep maintaining the broader meaning of knowledge and education in certain field (Fernandes, 2005). As time passed by and the advance of knowledge science and technology, then the most common definition of literacy is an ability which is related with set of skills in reading and writing.

The Program for International Student Assessment (PISA) define Literacy as individual ability to understand, use and reflect written text in order to achieve the desired goal and being able to develop potential knowledge so individual can participate in community (Elizabeth and Copeland, 2011).

Statistical literacy itself can be described as ability in reading and writing statistically. According to (Garfield, 1999) that statistical literacy is also ability to interpret, evaluate critically, and communicate about information and statistic message. The ability to understand statistic language comprise: words, symbol, term, and being able to interpret graphic, table, being able to read and understand statistic in news, media, discussion, another sources. In parallel with that, Gal (2000) revealed that statistical literacy is individuals' ability to interpret and evaluate critically statistic information in argument based data which appear in channel of various media and their ability to discuss it.

Refer to some opinion above, researcher has a view that statistical literacy can be defined as an ability to read, write, understand, interpret, analyze, and interpret data through skill possessed, and being able to understand and present information in the form of table, graphic, and statistic symbols contained in various media. Illustration of statistical literacy illustration is given below.

3. Student's Statistical Self-Concept

Success and failure in statistics course beside determined by ability possessed by student, also influenced by

some factors among other is self-concept. In lecturing, it is hoped that student has self-concept so can actively involved in lecturing which is effected on achievement of learning outcome. Student who has self-concept will has effective performance and being able to learn independently in various situations.

Self-concept as suggested by Marsh et al (Maurent & Margareth, 2012) is multi-dimension process which refer to individual perception from "self" in connection with some characteristics such as: physical performance, goal, values and self-esteem. This view show that self-concept very influence on how students feel about themselves, about their ability and decision they make related with their education.

Academic self-concept, according to Reyes (Tun and Yates, 2007) is self perception which related with academic and tend to focus on scholastic competence, not attitude. This is called as one's perception about self related with his/her academic achievement.

Campus environment can form student's self-concept. The forming of student's academic self-concept can be formed through interaction process at the time of learning, in which lecturer can trigger the forming of student's positive self-concept by: 1) giving motivation and encouragement to students in lecturing; 2) always giving reinforcement, so students can complete all assignments given; 3) giving praise toward their academic achievement and not jeer at outcome which is obtained by students; 4) developing interest and ability possessed, so students feel respected for the strength they have; 5) giving responsibility to be implemented. This can trigger students' positive self-concept because they feel to have ability to implement it; and 6) giving objective judgment toward students' performance.

4.   Collaborative Problem Solving Model Assisted By Literacy Media (CPS-AML) in Learning

The forming of student's self-concept in lecturing can be done by applying learning model of varied and innovative group. This make students can involve actively in interacting, being able to argue and cooperate, and being able to explore creative ideas they have. Clair and Chirara (2012) described that learning by using small groups is very beneficial and help student in searching solution to a problem, in which this way will trigger students to be active in learning process.

Group study can create learning environment which is able to facilitate student to achieve learning goal which is desired. One form of group study which is considered as effective to be applied in statistics course is collaborative model. According to Department of Education Training and Employment (2000), collaboration can facilitate student's learning which is distinct in various aspects. According to Panitz (Ruhchitra, 2008), collaborative learning is a personal philosophy, not merely learning technique in class. Collaboration is interaction philosophy and life style which make cooperation as interaction structure which is designed such a kind in order to facilitate collective effort to achieve common goal in problem solving. Next, it is confirmed that in various situations, when some people being in the group, collaboration is a way to connect by respecting each other and valuing ability and contribution of each group member.

Researcher has a view that collaborative model is a form of group study whose main goal is to form student to become strong individual, in which student can construct creative ideas and being able to transform his/her thinking outcome. Collaboration also can help student to be actively involved in interacting and cooperating as a structure in building ideas individually or as group in problem solving. Student who has diverse mindset can complete each other and improve weakness he/she has.

There are five stages in collaborative learning among others are: Engagement, Exploration, Transformation, Presentation and Reflection (Reid, 2004). It is hoped that syntax of this collaboration learning can facilitate student in statistics course particularly Elementary School student teacher.

Illustration of Literacy Media:

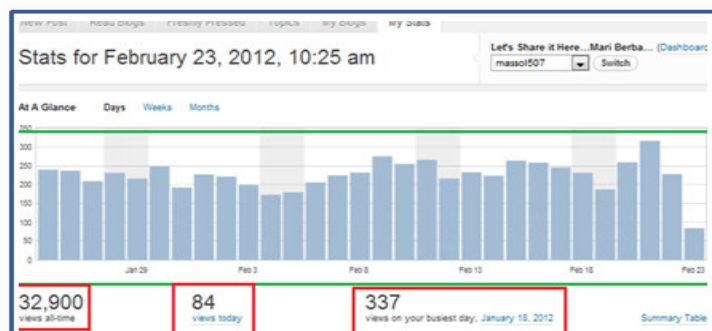A graphic is presented to viewers of mathematics blog which contained in website as follow:

Figure 1. The Viewers of Mathematics Blog on Website
Following is interpretation of information from display in Figure 1:

▪   The display in figure above describe the numbers of viewers of mathematic blog per days, per weeks,

and per months. This is seen from the main menu.

- From histogram, it is seen that level of mathematic blog viewers experience fluctuation, in which it is seen that the highest level of viewer occurred in date of February 21st and the lowest level of viewers occurred in date of 23rd. But in a whole, it is informed from graphic that the leap of biggest viewers occurred in date of January 18th 2012 with viewers reached 337 persons. This is seen from summary given. Next, it can be revealed that the viewers of this blog today are total of 84 persons and it can be informed that since this blog established, total of 32.900 persons which have viewed this blog.

5. Method of Study

This study use Quasi-Experimental in which there is no randomization. It means that grouping of sample member in each experiment group and control group is not done in random but class randomization is done. The use of Quasi-Experiment aim to reveal. Design of study which is used is Nonequivalent Pretest-Posttest Control Group Design, in which there are two groups, namely experiment group and control group. Experiment group is given treatment by using CPS-ALM model. Design of study is described as follow:

$$\text{Eksperiment Group (A)} \ : \ O \text{———} X \text{———} O$$
$$\text{Control Group (B)} \ : \ O \text{—————} O$$
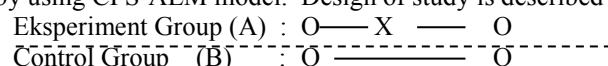
(Creswell, 2010)

Annotation:

O = the administration of mathematical representation and stastitical literacy test
X = collaborative problem solving model
----- = class randomization

Statistical literacy data is obtained by giving pretest and posttest comprise indicators of statistical literacy, while self-concept data is obtained through result of respondent filling in the form of self-concept scale (SCS) which contain two main components, namely conceptual and attitude components.

6. Result of Study

The aim to use N-gain <g> in this study is to find out category of student's statistical literacy enhancement after using CPS-ALM learning model and Expository Learning (EL). To do statistic test in seeing difference in average enhancement <g> of this statistical literacy, then process of parametric test assumption fulfillment should be done.

Based on normality test <g> of CPS group and EL group, normal distributed data is obtained but not homogeneous so nonparametric test is used. By using Mann-Whitney –U test like presented in Table 1, it is identified that Sig. (1-tailed) of 0.00 is smaller than 0.05 which means that Ho is rejected, thus it can be said that there is difference on <g> enhancement between students who are taught by CPS-ALM model and EL. This result indicated that the use of CPS-ALM model give contribution to student's statistical literacy enhancement which is better than EL.

Following test result is given to see difference in <g> enhancement for indicators of Statistical Literacy (SL). As for indicator of student's SL comprise ability to understand text-interpretation (AUT-I), analytical ability (AA), ability to understand text-data presentation (AUT-DP), ability to understand text-counting (AUT-C), and ability to analyze-interpretation (AA-I). SL ability of each indicator both for CPS group and EL group is presented in Table 3.

Table 3 *N-gain average of each indicator of SL*

No	Concept	Indicator	N-*gain*	
			CPS-ALM	EL
1	Data presentation (table)	KMT-I	0,72	0,38
2	Data presentation (graphic)	KA	0,31	0,21
3	Central Tendency	KMT-PD	0,60	0,30
4	Central Tendency	KMTB	0,59	0,19
5	Distribution Meausure Data (Dispersion)	KA-I	0,25	0,13

Annotation

AUT-I : Ability to Understand Text and Interpretation
AA : Ability to Analyze
AUT-DP : Ability to Understand Text-Data Presentation
AUT-C : Ability to Understand Text and Counting
AA-I : Ability to Analyze and Interpretation

Indicators of SL ability which is presented in Table 3 show that CPS-ALM group has <g> average which is higher than EL group. For AUT-I indicator of EL group has <g> as much as 0.72 which included in high category and CPS-ALM group as much as 0.38 (medium category). AA indicator of CPS-ALM group has <g> average as much as 0.31 which included in medium category and EL group is 0.21 (low category).

Concept of concentration measure with AUT-DP indicator is seen that ability of CPS group is higher double than EL group with <g> average for each are (0.60 and 0,30), both in medium level.

Another difference also showed for AUT-C indicator in which CPS group has <g> average as much as 0.59 and EL group as much as 0.19. Related with ability to analyze and interpretation (AA-I), it is seen that both groups have <g> average of (0.25 and 0.13). This result need to be enhanced because AA-I indicator of CPS-ALM group and EL group are enhanced but still in low category.

Related with student's statistical self-concept, it is identified that there is difference in student's self-concept enhancement between CPS-ALM group and EL group, in which CPS-ALM group achieve <g> average score of (0.33) which is in medium category whereas EL group achieve (0.16) which is in low category.

This difference show that group of students who use CPS model have self-concept which is better than EL group which is approached by expository learning.

Academic self-concept which is enhanced are: 1) view about ability and inability, in this case is process to understand material and solve statistic assignment given, ability in communicating, arguing and another ability with average of increase is 52%; 2) attitude and self confidence, comprise discipline in statistics lecturing, cooperate, autonomous, confidence in what have been done, obtain good result in statistics lecturing, can change negative view are increased by 53%; 3) sensitive toward oneself which comprise anxiety in following statistics lecturing, egoism, sensitive toward critics, felt belittled in lecturing, felt doubt toward what have been done, and sensitive toward praise are increased by 52.83%; 4) the others' view toward oneself which comprise; do not has ability = 52.83%; 5) self view toward future, among other statistics mastery can change the view to the future, being able to do activity in community, being able to become teacher as desired are increased by 59.38%.

Those academic self concept indicators are identified experience enhancement when student are collaborating in lecturing, in which they are demanded to have confidence toward the ability possessed in delivering creative ideas. Exploration which is done by students toward self ability demand a belief in their ideas.

Related with self concept then testing of two self-concept average of both groups is measured through N-gain by using nonparametric statistic test (Mann-Whitney U), because normality and homogeneity assumption of one group data is not fulfilled. Table 2 show that Sig. (1-tailed) =0.000 is smaller than 0.05 which means that statistical self-concept enhancement of students who are taught by CPS-ALM model is better than students who are taught by EL.

One way that trigger student's statistical literacy and statistical self-concept enhancement is the use of collaborative model.   That academic self-concept indicator is indicated experience enhancement at the time of collaboration in lecturing, in which student is demanded a belief in their ideas.

In process of idea transformation, arguments which are delivered demand a courage in communicate. This courage need self confidence toward ability to argue, beside in process of collaboration, students respect opinion of other people without noticing the ability they have. Respecting each other is viewed can omit negative self perception toward peers.

Lecturer as facilitator capable to give confidence for students to express without differentiating the ability they have. Attention and appreciation are also given as enforcement when students solve statistical items. Whatever the result, lecturer should constantly give praise and motivation in order that students do not feel there is negative view toward themselves.

Principally, in problem solving by using collaborative problem solving model in statistic concept which need skill, proficiency, analytical and interpretation ability, lecturer should be able to create learning atmosphere which is enjoyable, thus statistics which need mathematical calculation is viewed as interesting course and not invoke anxiety. This process will grow student's positive attitude about the importance of learning statistics, thus statistics and mathematics are viewed to have important role for student's future.

7.   Conclusion

Based on some findings about the application of collaborative problem solving model, then conclusions which can be drawn from this study are:

1. Based on criteria of testing (N-gain), it can be concluded that statistical literacy enhancement of students who learn by CPS-ALM (medium category) is higher than statistical literacy enhancement of students who learn by expository learning (low category).
2. There is difference in self-concept enhancement between students who learn by using collaborative problem solving model and ekspository learning, in which based on criteria of testing (N-gain), self-concept enhancement of students who learn by using CPS-ALM (medium category) is higher from self-concept enhancement of students who learn by using expository learning (low category).
3. Students give positive respons toward the use of collaborative problem solving model in statistics lecturing.

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Table 1. Difference test <g> of experiment group and control group

Statistik	Post_Rep_EK	Annotation	Decision
Mann-Whitney U	206,000		
Z	-4,778		
Asymp. Sig. (2-tailed)	0,000	Ho is rejected	There is difference
Asymp. Sig. (1-tailed)	0,000		

Table 2. Average difference test of N-gain Self Concept

Statistik	Post_Rep_EK	Annotation	Decision
Mann-Whitney U	122,000		
Z	-5,761		
Asymp. Sig. (2-tailed)	0,000	Ho is rejected	There is difference
Asymp. Sig. (1-tailed)	0,000		