PE - 4

THE EFFECTIVENESS OF LOCAL CULTURE-BASED PHYSICS MODEL OF TEACHING IN DEVELOPING PHYSICS COMPETENCE AND NATIONAL CHARACTER

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Abstract

Education has double functions, on the one hand it is aimed at developing the learner's self potential and on the other hand, it plays the role of preserving positive cultural values, both local and national, thus the role played by education and instruction becomes very important. In relation to this, through local culture-based physics instructional development, the learner's potential in the form of physics (science) competence and national character can be developed. Two development studies done consecutively in five years show very significant results. A quasi-experimental study was conducted using pretest-posttest only control group design with 380 seventh grade junior secondary school students dispersed in five public junior secondary schools in Singaraja, Bali. Based on the results of data analysis it can be concluded as follows. 1) There is a difference in the student's physics basic competence between those who learned through local culture-based model of teaching and those through the regular model of teaching (38.176; $p<0.05$). 2) There is a difference in physics (science) learning achievement between those who learned through local culture-based model of teaching and those through the regular model of teaching ($F=25.575$; $p<0.05$) Through a further testing using LSD, it was found that the means score of physics basic competence of the students who learned through local culture-based model of teaching is higher than that of those through regular model of teaching. 3) There is a difference in scientific performance between those who learned through local- culture based model of teaching and the regular model of teaching ($F=24.219$;$p <0.05$). The result of further testing also demonstrates that the means score of those who learned through local culture-based model of teaching is higher than that of those through the regular model of teaching. A further study with eleventh grade students of senior secondary school students who were dispersed in four public and private senior secondary schools in Singaraja using posttest only control group design shows the following results. 1) There is a difference in cognitive creativity between the students who learned through local culture-based model and those through the regular model of teaching ($F= 5.46$;$p <0.05$). The result of a further testing using LSD also shows that the means score in cognitive creativity of the students who learned through local culture-based model of teaching is higher than that of those through th regular model of teaching 2) There is a difference in scores of national character between the students who learned through local culture-based model and those through the regular model of teaching ($F=20.33$; $p <0.05$). A further testing also shows that the means score of the students who learned through local culture-based model is higher than that of those through the regular model of teaching. It can be concluded that local culture-based physics model of teaching is effective enough in developing physics competence and national character.

Key words: local culture-based physics model of teaching, physics competence, national character

INTRODUCTION

Various educational problems faced by Indonesia shows the poor quality of education. A study by Program for International Student Assessment (PISA) in 2009 shows that Indonesian students' literacy achievement in reading falls into the 57th rank, literacy achievement in mathematics the 61st and literacy achievement in science the 60th from 65 countries (OECD in Elianur,2012). Indonesia ranks the lowest tenth of PISA country participants. In addition, Trend International Mathematics Science (TIMSS) in 2007 reports about the average scores in the cognitive domain, an important aspect in the ability of problem solving in which Indonesia ranks 36th of 49 countries in the world (Gonzales *et al*., 2008). Indonesia' score in knowing is 425, in applying 426 and in reasoning 438, all of which are below the TIMTSS average of 500.

Another problem is the failure of education, especially science education in educating values at school as shown by various problems such as a high rate of drug use amongst the students and general public, fights amongst the students from different districts, damage of natural environment that has caused various disasters such as a continuous draught, flood, forest fire, air pollution, and Lapindo mud flow that has not been able to be overcome up to now. All of these have caused Indonesians' misery.

Adimassana (2000) claims that one of the causes is the failure in educational sector to teach values at school. Zamroni (2000:1) points out that education tends to become an instrument of "social stratification" and the school system only "transfers" what is known as dead knowledge to the students, that is too textbook centered (textbookish), severed from its roots and applications. Furthermore, Suastra (2005) states that values upheld by native people that are full with local genius are ignored in teaching, especially in science teaching at school. Hence, science teaching becomes "dry" and has less meaning for the students. This is what needs to a serious attention from the decision makers and practicioners of science education in the region.

Future science course needs a balance/ harmony among the science knowledge itself, the teaching of scientific attitude and the local genius values (the character of the nation) existing in the society. Hence, the students' sociocultural environment need a serious attention in developing science education at school since in it is hidden the native's science that can be useful for our life. Thus, science education will be useful for the students and the public. This is parallel to the view of today's science reform that emphsizes the importance of science for an attempt to promote social responsibility. Based on the effort in this reform, the objective of science education does not only improve an understanding of science itself, but more importantly is how to understand huan life itself. How the human beings create understandings of their natural world and how they interact with all systems of macrocosmos is largely determined by their view about the world and the universal values (Baker, 1995). The local culture based model of teaching is a model of teaching that starts with exploration of the students' ideas and initial beliefs and then relates them to the physics lesson that they are learning at school. The teacher plays a wise role as "broker" that provides a bridge to cross the two cultures, that is, the student's local culture and the scientific culture (the Western culture). The steps in the local culture based teaching are: (1) exploration of the student's local culture (knowledge and beliefs) that are relevant to the physics lesson of the moment, (2) focusing (the investigation focus) (3) inquiry investigation from various perspectives (scienctific, historical), (4) elaboration, and (5) evaluation (Suastra, 2012).

In the light of the background above, the problems investigated in this paper are 1) Can the local culture based model of physics teaching improve science basic competencies (physics learning achievement and student's scientific performance)? and 2) Can the local culture based model of physics teaching improve creative thinking and student's national character?

This paper can give an empirical and scientific justification on the effectiveness of a local

culture based model of teaching in improving physics basic competencies, thingking creativity, and student's national character. It can also be used as a reference for the scholars in science education and practicioners (science teachers) guru fisika/sains) as the basis in improving Indonesia's human resources.

RESEARCH METHODS

The study with junior high school SMP) students was done at the 7th grade with the sample of 380 students (6 experimental and 6 control groups). The students came from 6 public junior high schools in Singaraja. As the pairs of experimental and control groups were equivalent, this study used Post-test Only Control Group Design. The data on science learning achievement of the students were collected by a learning achievement test and the data on the students' scientific performance by observation. The data were analyzed by one-way MANOVA.

Before formulating a hypothesis, normality testing of data distribution was done using Kolmogorov-Smirnov and Shapiro-Wilk statistics, homogeneity testing of intergroup variants was done by using Levene's Test of Equality of Error Variance, intergroup variants matrix homogeneity testing by Box's M , and dependent variable colinearity testing by Product Moment correlation. The means significance comparation testing used Least Significant Difference (Montgomery, 1996). All of hypothesis testings were done at 0.05 level of significance which were analyzed using SPSS 17.0 PC for Windows dan Microsoft Excel 2007.

RESULTS AND DISCUSSION

The result of data analysis of the 7th grade students of SMP in the first semester showed that there was a significant difference in the student's science learning achievement and scientific performance between thes students who learned through local culture based model of teaching (MPBKL) and those who learned thrugh the regular conventional model ($F = 38.18$; $p < 0.05$). The science learning achievement of thes students who learned through MPBKL was higher than that of those who learned through the regular conventional model. Descriptively, the mean of the group of MPBKL was 65. 12**,** while that of the group of the conventional learning model was 58. 63. The result of the scientific performance of the students who learned through MPBKL was better than that of those who learned through the conventional learning model.. the mean of scientific performance of the students who learned through MPBKL was 23. 70, while that of those who learned through the conventional learning model was 21. 82. This means that MPBKL is more effective than the conventional learning model in improving science achievement and scientific performance at junior high school. In other words, ,MPBKL is effective enough to be used in developing student's basic competencies.

The result of the study with the 9th grade of public senior high school students in Singaraja is as follows. The general description of the study on the creativity score and national character values scores of the students who learned through MPBKL and those who learned through the conventional/regular learning model (MPK) can be seen in Table 1.

Table 1. Deskription of the scores on creative thinking and national character values

Statistic	Creative thinking		National Character	
	MPBKL	MPK	MPBKL	MPK
Mean	56.22	53.52	82.75	77.69
Median	57.00	54.00	82.50	77.5

Statistic	Creative thinking		National Character	
	MPBKL	MPK	MPBKL	MPK
Modus	60.00	42.00	88.00	83.00
Standard Deviation	8.53	8.93	8.40	8.55
Variance	72.77	79.72	70.61	73.05

Table 1 shows that the mean of student's creative thinking of the students who learned through MPBKL was 56.22, falling into sufficient qualification, while the mean of student's creative thinking of those who learned through MPK was 53. 52, falling into less sufficient qualification. The mean in national character for MPBKL was 82. 75, falling into good qualification, while the mean in national character for MPK was 77.69, also falling into good qualification.

There are four aspects of creative thinking being evaluated in this study, namely fluency, flexibility, originality, and elaboration. Based on the result of measurement it was found that the means for the student's creativity which have been converted into 100 can be seen in Table 2.

Table 2. Means for Each Aspect of Creative thinking

No.	Aspect of Creative thinking	Mean			
		MPBKL	Qualification	MPK	Qualification
1	Fluency	67.22	Sufficient	64.00	Sufficient
2	Flexibility	13.89	Very Insufficient	12.87	Very Insufficient
3	Originality	87.72	Very Good	83.99	GoodBaik
4	Elaboration	65.64	Sufficient	64.33	Sufficient

Based on Table 2 it can be shown that the originality aspect of MPBKL group has qualification Very good, while that of MPK group has qualification Good. In terms of fluency and flexibility, both MPBKL and MPK have qualitification Sufficient while in terms of flexibility both MPBKL and MPK have qualification Very Insufficient. Viewed from the mean in creative thinking, MPBKL has the mean of 56. 22, better than MPK , which is 53. 52, falling into qualification Insufficint. It can also be added that the students who learned through MPBKL has a high level of creativity than those through MPK. However, these data need a serious attention in the teaching and learning process in the future as to ensure a higher level of student's creativity, particularly in terms of flexibility, since it falls into qualification very insufficient for both groups.

There are six aspects of of national character evaluated in physics learning, namely honesty, tolerance, discipline, responsibility, curiosity and *jengah(*motivation to exel). Based on the results of the study it was found the following scores which have been converted into 100 in Table 3.

Table 3. Means for Each Indicator of National Character

No.	Aspect of National Character	Mean			
		MPBKL	Qualification	MPK	Qualification
1	Honesty	80.04	Good	75. 4	Good
2	Tolerance	85.31	Very Good	83.11	Good
3	Discipline	82.24	Good	78.73	Good
4	Responsibility	85.09	Very Good	82.68	Good
5	Curiousity	82.46	Good	79.39	Good
6	*Jengah*(motivation to exel)	80.04	Good	66.23	Sufficient

Based on Table 3 it can be shown that in MPBKL group , two indicators, tolerance and responsibility get qualification Very Good.,while four other aspects, namely honesty, discipline, curiousity, and motivation to exel get qualification Good.. In MPK group, five indicators, namely honesty, tolerance, responsility, discipline, and curiosity get quality Good, while one aspect (motivation to exel) gets qualification sufficient.. This indicates that in the group who learned through MPBKLtheir national character, in general, is better , both in terms of mean and each aspect when compared to the ones who learned through MPK.

The result of the testing of the hypothesis that says that there is a difference in creative thinking and national character between the group of students who learned through MPBKL and the group who learned through MPK can be seen in Table 4.

Table 4. Recapitulation of One-Way MANOVA Results

Multivariate Tests					
Effect		*Value*	*F*	*Hypothesis df*	*Sig.*
Group	*Pillai's Trace*	.09	11.19[a]	2.00	.00
	Wilks' Lambda	.91	11.19[a]	2.00	.00
	Hotelling's Trace	.10	11.19[a]	2.00	.00
	Roy's Largest Root	.10	11.19[a]	2.00	.00

Based on the recapof analyses using One-Way MANOVA in Table 4 it can be interpreted that the levels of significance for *Pillai's Trace, Wilks' Lambda, Hotelling's Trace*, and *Roy's Largest Root* are smaller than 0. 05 that **H_0 rejected**. Hence, there is a difference in creative thinkingband national character between the group of students who learned through MPBKL and the group who learned through MPK.

The testing with MANOVA shows that there is a sifnificant difference in creative thinking and national character between the group of students who learned through local culture based model of teaching and the group who learned through conventional model. The results of testing using MANOVA of the hypothesis of study 1, particularly when viewed from the statistics of *Pillai's Trace*, *Wilks' Lambda*, *Hotelling's Trace*, and *Roy's Largest Root* respectively show F = 11.19 significant ati 0.00, which is smaller than 0. 05, that the student's creative thinking and national character are significantly ($p < 0,05$) affected by the model of teaching implemented.

A further result using LSD shows that there is a difference in mean between the MPBKL students and the MPK students. $\Delta\mu = [\mu(MPBKL) - \mu(MPK)] = 5.06$ with Standard Deviation of 1. 12 at 0. 00 level of significance, which is smaller than 0. 05. $\Delta\mu$ value is greater than the value for rejecting LSD. Hence, the means for national character of the group of students who learned through local genious based learning model and the group of students who learned through the conventional model differ significantly at 0. 05.

In accordance with the descriptive analysis and one-way MANOVA results , then ther can be a justification that MPBKL gives a better effect on the attainment of creative thinking and national character than MPK. The followings are some of the reasons as the basis of the justification.

First, in the lesson plan that is based on local genious (MPBKL) the aspects of character are explicitly described in the indicators and the objectives, whilel in the lesson plan based on conventional model (MPK) they are not explicit. By making them explicit in the lesson plan the

give a clearer direction to the teacher in developing them in each step of learning activity. This is in line with the point of view of Gufron (2012) who says that the teacher has understand first the national character value related to the formulation of competencies expected to be mastered by the student and then he/she has to formulated its in the lesson plan.

Second, theoretically, the teaching and learning process that is based on local genious starts teaching activity by discovering initial ideas and belielfs of the students in relation to the material to be learned based on constructivism that sresses that student's prior knowledge needs to be discovered and then used as reference in learning. This is in line with Ausuble (in Suastra, 2013) that says that the most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly. Then, the teacher focuses the student's attention to prepare the investigation of ideas and their initial ideas. The activity of focusing is meant to direct the students to comprehend the instruments and steps that are needed to test the initial ideas so that the investigation is more directed and does not need much time. The second step from MPBKL is an inquiry from various perspectives. In this step, the students do the investigation, oth from the scientific perspective and form the historical/ sociocultral perspective. If the concept is related to the scientific concept, then the activity is a scientific inquiry. However, if it is related to the sociocultural concept, then it can be investigated from the sociocultural perspective, including historical one. This is in line with Liston (2009) who states that inquiry based learning will have a better impact in developing science and mathematics knowledge and skills , particularly critical thinking skill. Inquiry is the form of learning that requires students to ask questions, to obtain knowledge, and to discover a phenomenon. Minner (2009) also states that inquiry based learning , in addition to increasing student's understanding of concepts, it also is able to develop his or her creative thinking and responsibility for his or her learning. In other words, inquiry acitivities done by the students give them the opportunity to develop their way of learning. Wegerif (2010) says that learning how to learn is very helpful in developing the student's creative thinking. Furthermore, Meador (1997) says that creative thinking is not only needed art, music, or drama, but it is also needed for *real life,* particularly, in solving problems in jobs such as fluent, flexible, original, and elaborative thinking. Munandar (1999) emphasizes that the four aspects of creative thinking are very important and can continuously be developed in teaching. Hence, the results of this study are very positive to be continuously developed in the future. The nutruant effect of this inquiry activity is the ability to develop scientific attitude of the student such as being objective (honest), critical, curious, studious/ discipline, always wanting to produce something better/ more perfect so that can be trusted by the community (*jengah* in Balinese local genious based national character). Suastra (2011) mentions this attitude as *scientific character* that is also included in Balinese local genious based national character. This is supported by Minner (2009) who says that inquiry based teaching in addition to improving the student's understanding of concepts, it also can develop a high level of thinking (creative thinking) and sense of student responsibility for learning.

Third , the integration of local genious particularly local genious in physics learning gives a different nuance in learning. The integration of local genious in physics learning makes physics learning not as "scary" as the student's initial perception toward physics as a difficult subject, but it makes the student closer to his or her natural and sociocultural environment. This is in line with Suastra (2010) who says that science is not only understood by an exclusive group, but becomes science for daily living, science for the future, and science for all. To bridge the students from the native science (eastern culture) toward scientific science (western culture), George (2001) recommends the use of collateral learning theory. when the student's ideas/ beliefs fit into physics concepts, then what happens is secured collateral learning. But, when the physics concept learned differs from the native concept, then they should not be contrasted, but they should be let go together (*parallel collateral learning*).

CONCLUSION AND SUGGESTION

Based on the problems and results obtained form the study, it can be concluded that local culture based model of teaching is effective enough to be used to develop physics basic competencies, creative thinking, and national character. In developing it at school there are some points needed to be done as follows. (1) The teacher needs to analyze national character values based on local genious which fit in the basic competencies and explicitly state them in the indicators and learning objectives (2) the students are given the opportunity as much as possible to express ideas/beliefs that are related to physics lessons, although they do not fit in the scientific concepts . The teacher is not allowed to say that the ideas/ beliefs are right or wrong. (3) The role of the teacher in learning activity is as a facilitator and a wise guide (cultural broker) to take the students to cross from the student's culture (local culture) toward scientific science (western culture). The teacher can use collateral learning theory in guiding the student's learning process. (4) In discussion actitity, the teacher can start from things that are factual to open ended questions, "why", "how", and "what if". (5) To assess national character values regular observations aided by character assessment rubric can be used. (6) The government/schools need to provide sufficient facilities of physics laboratories to help the students in doing scientific research continually.

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