THE CONTRIBUTION OF MULTIPLE INTELLIGENCE BASED OF MATHEMATICS LEARNING IN BUILDING THE CHARACTER OF *PGMI* (ISLAMIC ELEMENTARY SCHOOL TEACHER EDUCATION) STUDENTS[1]

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ABSTRACT

This research is aimed to figure out the contribution level of *multiple intelligences* based of Mathematics learning of the student character on the aspect of cooperation, responsibility, and creativity. The subjects of this research are 30 students of the A class, 4th semester, chapter 2010 of *PGMI* (Islamic Elementary School Teacher education). This research uses *ex post facto* type of qualitative method. Based on the questionnaire data, the results of this research reveals that the contribution of multiple intelligences based of mathematics learning on three aspects of a character is in a very good category; it is 80.4%. female Students give the perceptions on all three aspects in the very good category. On the other hand, male students give the perception in quite well category, except on the aspect of responsibility by 76% with a very good category. The students of High School alumni have the highest perception on three character aspects in very good category. Then followed by vocational high school alumni and the others, they are in very good category except in the aspects of creativity; it is good enough by 71.35%. Then the lowest perception is given for the alumni of Islamic high school in the unfavorable category, except in the aspect of cooperation; they are categorized good enough by 62.5%. In all the analysis, creativity aspect is in the lowest level; they are 72% for all the analysis, 75,4 % for the female students, 64% for the male students, 48,6 % for Islamic high school, 75,2% high school, and 71,35 % vocational high school and the others.

Key word: character, *multiple intelligences,* mathematics learning

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A. INTRODUCTION

Educational problem is a very complex problem. It is said by Prof. Dr. Ir. H. Mohammad Nuh, DEA as the new National Educational Ministry in the united Indonesia Cabinet II at the handover of National Educational Ministry ceremony, in October 22, 2009[3]. Hence, the active participation of all national components is very necessary to overcome those educational problems.

Anarchist behavior phenomena, disputing and fighting among students, citizens, and schools, vigilantism, authority abusing, corruption, drug abusing, and interpersonal relationships which increasingly does not respect the ethical values and manners that become the concern of our educational world[4]. It definitely will be dangerous if the educational world does not immediately fix those educational problems. To deal with these problems, the government has responded swiftly, so that they have prompted the Indonesian government to create a national policy of National Character Development for Year 2010-2025 where the national policy has the objective to[5]:

> "... build and develop the character of citizens so that they can create a society that beliefs in one God, being a human who is fair and civilized, having spirit of the Indonesian unity, having spirit of democracy led by the inner wisdom in representation deliberations and social justice for all Indonesian people ..."

In its implementation, the responsibility to provide good education becomes a responsibility for all levels wholly from primary, secondary, to higher education levels. Colleges which become the foundation of society to form a human who has certain character have a responsibility to implement those challenges. Components of the academic community have to do the real participation in the class. PGMI (Islamic Elementary School Teacher Education) major in the faculty of *Tarbiyah* and Teaching becomes an integral part to play a role in the improvement of education. PGMI major has a strategic role in forming teacher applicant for MI (Islamic Elementary School). This way, PGMI lecturers can implement a learning process that can support to form a good and a strong student.

Theory of Multiple Intelligences developed by Howard Gardner was officially introduced in 1983 through his book *Frames of Mind* which was then revised at the 1999[6] as *Intelligence Reframed*. The development of multiple intelligences study led to a new awareness that human beings as God's creature are created in diversity. So that they should accept this as a gift that can become a positive potential to support each other, and it is not as a different potential to become selfish each other.

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[3] Zainal Aqib and Sujak. 2011. Panduan dan Aplikasi Pendidikan Karakter untuk SD/MI, SMP/MTs, SMA/MA, SMK/MAK. Bandung: Penerbit YRAMA WIDYA. Page: iii

[4] Hamruni. 2012. Pendidikan Karakter dalam Pembelajaran Anak Usia dini Berbasis Edutainment (Musik dan Lagu Model)dalam Proceeding Pendidikan Karakter-Spiritual Anak Sebagai Pilar Membangun Masyarakat yang Beradab Yogyakarta: Prodi PGMI Fakultas Tarbiyah dan Keguruan UIN Sunan Kalijaga Yogyakarta. Page: 1

[5] Darmiyati Zuchdi. 2011. Model Pendidikan Karakter Terintegrasi dalam Pembelajaran dan Pengembangan Kultur Sekolah. Yogyakarta : UNY Press. Page: 32

[6] Ibid. page: iii

The theory of multiple intelligences that respects the intelligence from various facets can be developed in mathematics learning to encourage students who do not like mathematics remain comfortable in learning mathematics. Even it can grow the intelligence beyond logical-mathematical intelligence, such as linguistic, musical, and intrapersonal to keep growing. The good implications of this are not only learning mathematics becomes more attractive, but also other intelligences can be nurtured. Moreover, it can contribute in building of the students' character.

Mathematics lectures which are designed in certain way will be able to establish cooperation among the students. When each member of the group gets a different task or gets the same tasks among group members, they do not only grow the cooperation, but they also grow responsible attitude in their group.

Furthermore, the design of the courses that give space to students to think and convey their ideas freely will be able to encourage the growth of one's creativity. The freedom here is certainly still within the limits which are specified by a rule or a certain criteria. Professor Suharnan said that creative processes would be going on flexibly in a state between freedom and discipline[7].

Some researches have proven that the multiple intelligences paradigm can give a positive contribution to the learning process. It can encourage many researchers interested in conducting research about the contribution of multiple intelligences based of mathematics learning in building character of the students. The problem statement that will be analyzed in this research is: how is the contribution of multiple intelligences based of mathematics learning in building the character of the students in the aspects of cooperation, the responsibility, and the creativity?

B. METHOD OF RESEARCH

This research is a research with *the ex post facto* design which is often called as *after the fact*. It means this research is a research which is conducted after an occurred event. It also is called as *retrospective study* because this research is a research that tracing back to an event and then trace backwards to determine the factors that may cause the event.

In more specific explanation, Furchan explains[8] that *ex post facto* research is a research that is conducted after the differences in the free variable occurs due to the development of a natural occurrence. *Ex post facto* research is a research which treatment of its independent variables is not performed at the time of the research, so this research is usually separated by an experimental research.

1. Time

The time of this research is at the Mathematics 2 Course and the Learning which was held at the second semester of 2011/2012 academic year. Then the researcher analyzed the data at

[7] Suharnan. 2011. Kreativitas: Teori dan Pengembangan. Surabaya: Penerbit LARAS. Page: 26

[8] Arif Furchan. 2004. Pengantar Penelitian dalam Pendidikan. Yogyakarta: Pustaka Pelajar. Page: 383

August to September 2012. Thus, the time which was spent to conduct this research is about seven months i.e. February to September 2012.

2. Place

The place of this research was in PGMI (Islamic Elementary School Teacher Education) major in the faculty of *Tarbiyah* and Teaching State Islamic University Sunan Kalijaga of Yogyakarta.

3. Subject

The subjects of this research were the A class students of the fourth semester in PGMI (Islamic Elementary School Teacher Education) major.

4. Object

The object of this research is the whole learning process in the Mathematics 2 Course and the Learning, especially at 2nd, 3rd, 6th, 7th, 11th, and 14th meetings.

5. Independent variable

Independent variable is variables which is suspected as the cause of another variable. The independent variable is usually manipulated, observed, and measured to figure out the effect and its contribution to other variables. The independent variable of in this research is multiple intelligences based of Mathematics learning.

6. Dependent variable

The dependent variable is the variable that arises as a result of manipulation or treatment of independent variables. The dependent variable is usually observed and measured to find out the result as the effect of the independent variables. The dependent variable of this research is the character, especially the responsibility, cooperation, and creativity aspects.

7. The data collecting technique

a. Documentation

Documentation is done by collecting the syllabus data of Mathematics 2 Course and the Learning, college journals, photographs of multiple intelligences based learning process i.e. LCC, and files and scripts of multiple intelligences mathematic classes.

b. Interview

Interviews were conducted by observing three assumptions that according to Hadi Sutrisno are important to be understand by the researcher[9]. They are: (1) Respondents are people who

[9] Sugiyono. 2009. Metode Penelitian Kuantitatif , Kualitatif dan R&D. Bandung: ALFABETA. Page: 138

most understand about themselves, (2) What is stated by the respondent to the researcher is true and trustworthy, (3) Interpretation of respondents upon the question - the question in the interview guide is the same to the interpretation of the researcher.

Interviews which were conducted in this research is unstructured interviews in which respondents' answer is an unrestricted by interview guidelines which are systematically arranged.

c. Filling the Questionnaire

The questionnaire is a data collection technique in which respondents received a set of questions or written question to be answered[10]. In this research, the researcher used a set of questionnaires that need to be answered with a statement using four alternative answers of *Likert SKAL*; they are Never, Sometimes, Often, and Always. The answer scores ranged from 1 to 4. The criteria of the answer that gets 4 value score is the answer "always", 3 for "often", 2 for "sometime", and 1 for "never". The scoring guidelines are in the following table:

Choices alternative	Type the positive statement
Always	4
Often	3
Sometimes	2
Never	1

It will be obtained a score tabulation character based on the table. The higher the score means the higher the character level too, and vice versa. Thus, the questionnaire data in this research can be used as the primary data, while the results of the interviews and the documentation are used as supporting data to sharpen the discussion.

8. The Research Instrument

a. Documents

The documents which are used are the Mathematics 2 Course and the Learning equipment in the second semester of 2011/2012, LCC manuscripts, photographs of multiple intelligences-based mathematic classes.

b. Interview Guide

Interview guide was created as a guideline when doing interviews as an additional data or secondary data. Then, interview guides were distributed to six students that representing the

[10] Sugiyono. Page: 142

class. From those six interview guides, they were taken three categories of mathematic skills, i.e. good, middle, and less each two students per skill.

c. Character Scale Questionnaire

Character scale questionnaires were adapted from Character Development Scale (CDS) proposed by Keohane[11]. Then the development of identity column is adapted from professor Djohar et al' of research instruments[12].

d. Researcher

Researcher is an important instrument in this *ex post facto* qualitative research. It is because researcher is planner, implementer, data collector, the data analyzer, interpreter of data, and finally reported the research. At data collection section, the researchers collaborated with three students to help the researcher to collect the data and make a manual count of the questioners.

C. Data Analysis Technique

Data analysis techniques is started from data collection in the form of documents; they are the syllabus of Mathematics 2 Course and Learning, Journal of Mathematics 2 Course and Learning at the even semester of 2011/2012, photographs of LCC, and files and scripts lectures. Data results of the questionnaire and unstructured interviews were also collected. Then the researcher did the data reduction: 30 data were selected from 40 questioners which worth to be processed. The incomplete data, for example there is unfilled number in the questionnaire, double answer in the same number, or incomplete identity is not included in the data analysis. Data analysis is done manually by calculating the overall scores of character aspects (intact). Then scores per aspect, including three aspects and character scores are seen based on the gender and the origin of high school.

Calculation of the character criteria can be defined based on the percentage that can be classified based on the following calculation.

$$\text{Percentage}[13] = \frac{\textit{the total score of data collection}}{\textit{Total Score of CRITERION}} \text{ X 100 \%}$$

Explanation:

Score of criterion = highest score x number of statement items x number of respondents

Score of criterion = 4x20x30 = 2400

Score of data collecting result = 20 items score recap of all respondents

[11] Eva Latipah et al. 2011. Membangun Karakter (Character Building) Mahasiswa Calon Guru Madrasah Ibtidaiyah Melalui Model Pembelajaran Role Playing. Yogyakarta: The report of research result of Laporan hasil penelitian LEMLIT State Islamic University Sunan Kalijaga of Yogyakarta. Page:77-79

[12] Djohar et al. Kontribusi Kesadaran Beragama dan Media dalam Membangun Penampilan Karakter Diri di Lingkungan Keluarga, Sekolah, Masyarakat, dan Diri Sendiri. Sleman: the Studi of the perception senior high school students in Sleman Regency

[13] Sugiyono. 2009. Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: Penerbit Alfabeta. Page: 99

Calculation of the criterion score: 4 x 20 x 30 = 2400

If it is divided into 4 categories: 2400:4 = 600

Categorization[14]:

Category	Range of Score	Percentage
Very Less	0-600	0 %-25 %
Deficient	601-1200	25, 1 % - 50%
Good Enough	1201-1800	50,1 % -75%
Very Good	1801-2400	75,1 %-100%

The interviews were analyzed and then presented as a supporting research in the discussion section. All the relevant documents are also used to complete this research.

D. Results and Discussion

1. Design of the Multiple Intelligences Based of Mathematics Learning

The design of instructional or lecturer of multiple intelligences based Mathematic Learning is implemented as follows:

a. At the second and the third sessions of the class, the students practice to use abacus and *jarimatika* (using finger to solve simple Mathematics counting problem).

b. At the sixth and seventh sessions of the class, the student learn to solve prime number and Least Common Multiple (LCM) and Greatest Common Divisor (GCD) topics, by using visual aids such as beads, rhythm game with lights, etc.

c. At the eleventh to fourteenth sessions of the class, the student learn to solve Cartesian coordinates ("Playing: where is your position?" and a series of LCC (Quiz Competition)

2. The Description of the 3 intact Character aspects

Based on the calculation summary by using Microsoft Excel: 30 students obtained a score totals: 1930 by using the percentage as follows:

Percentage = (1930 / 2400) x 100% = 0,804 x 100 % = 80,4 %

[14] Ibid. Page: 99

3. The Description of Each Character Aspects

Once the statement is calculated per item based on its aspects: cooperation aspects item: 1,2,3,4,11,12,15,18, responsibility aspects item: 5,6,7,13,14,16, and creativity aspects item: 8, 9,10,17,19,20 are obtained the scores as follows.

Character	Student Score	Percentage
Cooperation	0,833333333	83%
responsibility	0,854166667	85%
creativity	0,715277778	72%

4. The Description of the Character Based on Gender

Calculations of the character aspects data is divided based on the gender of male and female. The scores are as follows:

Character	Male Score	Female Score
Cooperation	0,71875	0,890625
responsibility	0,758333333	0,902083333
creativity	0,6375	0,754166667

Calculations of the character aspects data is divided based on the gender of male and female. The percentage scores are as follows:

Character	Percentage of Male	Percentage of Female
Cooperation	72%	89%
responsibility	76%	90%
creativity	64%	75,4 %

5. The Description of the Character Based on the origin of High School

Score calculations of the character per aspect based on the origin of High School are as follows:

Character	Islamic High School	High School	Others
Cooperation	0,625	0,875	0,8125
responsibility	0,486111111	0,907894737	0,864583333
creativity	0,486111111	0,752192982	0,713541667

Meanwhile, the percentage is as follows:

Character	Islamic High School	High School	Others
Cooperation	62,5%	87,5%	81,25%
responsibility	48,6%	90,8 %	86,46%
creativity	48,6%	75, 2%	71,35%

E. DISCUSSION

1. Design of Multiple Intelligences Based of Learning Mathematics

a. At the second and the third sessions of the class, the students practice to use abacus and *jarimatika*

The implementation of this session is done by using abacus as the visual learning tool for counting, and multiplication count by using *Jarimatika* starts from 6x6, 6x7, ..., up to 9x9. After that they learn about multiplication 11x11, 11x12, 12x12, ..., 19x19 and so on up to 49x49. The example of *Jarimatika* for 6x6 multiplications is it is demonstrated with 4 folded fingers and thumb straight. Two straight thumbs indicate 2 tens, then the 4 folded finger are multiplied so that it produces 16 and is added to 36. 7x8 multiplication can be solved by folding the left little finger and ring fingers, then three right fingers are folded; five straight fingers shows 5 tens, and those folded fingers are multiplied so that it produces, then if they are all summed, they will be scored 56.

This abacus and *Jarimatika* practice and learning according to Munro are studies to develop intelligence kinesthetic[15].

[15] John Munro. 1994. "Multiple Intelligences and Mathematic Teaching" (paper at the Annual conferenceof the Australian Remedial Mathematics Education Association). Melbourne. Page 4

b. At the sixth and seventh sessions of the class, the student learn to solve prime number and Least Common Multiple (LCM) and Greatest Common Divisor (GCD) topics by using visual aids such as beads, rhythm game with lights, etc.

Learning Mathematics about Least Common Multiple (LCM) and Greatest Common Divisor (GCD) topics are started by understand the definition of LCM and GCD, then tried to learn calculating some multiples manually, Common Multiple and selected the smallest. For GCD, it is started by find the divisor, then definite Common Divisor and selects the greatest divisor. Then, they also will learn about the concept of prime divisor. The example about GCD case is as follows:

"... Mrs. Asti harvests 24 citrus, 36 mangos, and 40 star-fruits. They will be distributed to the neighbors in the bag for each of them. How are many neighbors that got the MOST portion of the crop if the contents of each fruit per bag are the same? (Additions: how many are the fruit in each bag?) ... "

According Yaumi, the examples of learning mathematics with this concept is an example of learning that develops natural intelligent[16]. Meanwhile, learning LCM is exemplified and practiced by using rhythm, for example:

"... Ahmad hits cans every 3 seconds, Diva hits the board every 5 seconds and Ilma hits the box every 8 seconds. If the first blow starts at 09:15, at what time are they will hit the fifth blow together? ... "

Example of practical implementation of learning mathematics with the knock example is the implementation of learning mathematics using musical intelligence[17].

c. At the eleventh to fourteenth sessions of the class, the student learn to solve Cartesian coordinates ("Playing: where is your position?" and a series of LCC (Quiz Competition)

The eleventh meeting begins with an explanation of Cartesian coordinate concept. The explanation begins with the students that act as coordinate points. One of the students is made as the central point (Origin), and the other students are called to be questioned: "Where is your position?" Students should answer based on the position of origin; "is it on the right or on the left of origin position?" and "how many steps are the distance?" It is what is called as abscissa concept and how many steps it is located around the origin point, that is the concept of ordinate. Implementation of learning mathematics in this way can develop linguistic, visual, and bodily-kinesthetic intelligence as well. The implementation of the LCC (Quiz Competition) is prepared at 12th and 13th meeting for the preparation. Meanwhile, the implementation is done at 14th meeting. LCC design produces various components; they are executive officers, event design, group supporter costume, group yells, and the race rules and regulations.

[16] Muhammad Yaumi. 2012. Pembelajaran Berbasis Multiple Intelligences. Jakarta: DIAN RAKYAT. Page: 203-223

[17] Yaumi. Page: 132-141

d. The overall design of the LCC event

At the division of the task, students did the discussions. This can develop interpersonal intelligence in the form of teamwork. Furthermore, in the team, there is also an act division; it consists of act of being THE HEAD OF DEPARTMENT, JUDGES, PARTICIPANTS / STUDENT, and so on. It is part of the role acting (role-play) which can develop the kinesthetic intelligence among students[18]. Furthermore, in the implementation of the competition, there is a student who acts as the head of department that gives a speech; there are also judges who read the order and other things to handle the event. It is the way to develop the linguistic intelligent.

At the question reading time, at first round to third round participants must obey the rules; they are forbade to cheat and so on. It is the way to develop interpersonal intelligence where the students should control themselves.

Furthermore, when a group of supporters shows their yells, they wore a certain costumes. They are as follows:

1) Women in Abu Bakr team are wearing a blue shirt and blue veil.
2) Women in Gus Dur team are wearing a black dress and a red veil
3) Women in Ibn Sinateam are wearing a white shirt and wearing a head cover made from newspaper.

This is a mathematics learning that develop visual intelligence.

When the students create slogans and perform it by sing it excitingly, it has become a model or an example of the implementation of learning mathematics that completes with the development of musical intelligence.

2. The Description of the 3 intact Character aspects

In the calculation of the character intact (all three aspects are not separated) percentage was obtained by 80.4%. This is included as the excellent category. It means based on the perception of the whole student, multiple intelligences based learning can contribute to the three aspects of the very good character category.

3. The Description of Each Character Aspects

With the percentage of cooperation character aspect by 83%, responsibility by 85%, and creativity by 72%, this shows that students feel that a multiple intelligences based learning contribution is considered in the excellent category on aspects of cooperation and responsibility. Whereas in the creative aspects contribution is considered in the quite well category. If it is seen from the number the percentage, according to students, the largest contribution is in the aspect of responsibility.

[18] Yaumi. Page: 116

4. The Description of the Character Based on Gender

The percentage results of three character aspects of male students in cooperation are by 72%, responsibilities by 76%, and creativity by 64%. From these three aspects, cooperation and creativity is in the quite well category, and responsibility is in the excellent category. Whereas, the female student perception is by 89% on the cooperation aspect, by 90% in responsibility aspect, and by 75.4% in creativity aspect, it indicate that all three aspects of the characters got a contribution in good category based on the implementation of multiple intelligences-based mathematics learning. If it compared between male and female students, it can be seen that the three aspects is higher in the female students' percentage than the male.

5. The Description of the Character Based on the origin of High School

The result of the percentage calculation of students' perceptions on three character aspects is very interesting. The percentage calculation of Alumni Islamic high school i.e. the cooperation aspects is 62.5% responsibility aspect is 48.6%, and creativity aspect is 48.6% looks much lower than the high school alumni student who gives the perception of cooperation aspect by 87.5%, responsibility aspect by 90.8%, and creativity aspect by 75.2%. Then other Alumni (from Vocational high school, etc.) give the perception on 3 aspects in quite well i.e. cooperation by 81.25%, responsibility by 86.46%, and creativity by 71.35%. It can be sorted as: the lowest percentage is Islamic high school alumni, followed by the vocational high school alumni and others, and the highest is the high school alumni. It can be categorized that Islamic High School alumni is categorized poorly in responsibility and creativity aspects and quite good in cooperation aspects. Whereas, High School category shows that those aspects are categorized highly for them. Then, for vocational high school and the other is categorized as very good in the cooperation and responsibility aspects and quite good in creativity aspect.

6. The description in general

From the overall results, it can be seen that the calculation of the percentage of creative aspects includes in the lowest level of the entire calculation sequence either on the calculation of all students, by gender, or school origin category. Then the aspects of cooperation and responsibility are relatively balance and is not different too significantly.

F. CLOSING

1. Conclusion

a. The implementation of multiple intelligences based of mathematics learning with properties, games and Quiz Competition design can develop logical-mathematical, linguistic, kinesthetic, musical, visual, interpersonal, and intrapersonal intelligence.

b. Multiple intelligences based of Mathematics learning give a contribution for three character aspects; they are cooperation, responsibility and creativity aspects by 80.4% in very well category.

c. Female students give the perception in the very good category at contributions of multiple intelligences based of mathematics learning on three characters in aspects of cooperation, responsibility and creativity. On the other hand, male student gives the perception in quite well category, except for the responsibility aspect by 76% i.e. in very good category.

d. Students of High School alumni have the highest perception on three character aspects with a very good category. Then it followed by Vocational high school alumni and the others with very good category too except the creative aspects; it is good enough by 71.35%. Then the lowest perception category is given for the alumni of Islamic High School; it is unfavorable aspects, except the category of cooperation aspect by 62.5% in good enough category.

e. the overall analysis of the creative aspect is sorted from the lowest order as follows: Integrated assessment of character is 72%, female students is 75.4%, male student is 64%, alumni of Islamic high school is 48.6%, alumni of high school is 75.2%, while alumni of vocational high school and the others is 71.35%.

2. Suggestion

this *ex post facto* research only analyzes about "impression" of students on multiple intelligences based of mathematics learning. For a more depth research, the researcher suggests:

a. The research of class action is needed to increase the interest, participation, motivation, and achievement in the presence of multiple intelligences based of mathematic learning.

b. An experiment can be performed to determine the significance of its effect on the interest, participation, motivation, and achievement of the student.

c. R & D research is needed to develop component of multiple intelligences based of mathematic learning, for example: lesson plans, teaching materials, visualization tools, mathematic game design, and so on.

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