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"Building the Nation Character through Humanistic Mathematics Education"

Presented by :

Yogyakarta, July 21-23 2011

Department of Mathematics Education
Faculty of Mathematics and Natural Science
Yogyakarta State University

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Department of Mathematics Education
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2012

Preface

Assalaamu'alaikum Warahmatullaahi Wabarakatuh.

First of all, we would like to say alhamdulillah, thank to Alloh SWT, the most gracious and the most merciful, therefore the proceeding of The Fourth National Conference on Mathematics Education can be finished successfully. The conference was held on 21 – 23 July, 2011 for the cooperation of Universitas Negeri Yogyakarta (Yogyakarta State University) and and Indonesian Mathematical Society (IndoMS). It is an honor for us to be entrusted by IndoMS and UNY to organize The Fourth National Conference on Mathematics Education. The theme of the conference was "Building the nation character through humanistic mathematics education" and the aims were to be a forum for researchers, lecturers, teachers, students, and people who were care in mathematics education to share positive, constructive and creative ideas in relation to the development of the nation character through humanistic mathematics education.

We are very happy and proud, because we have seven invited speakers in their expertise, three invited speakers are from abroad (Prof. Christa Kaune, Germany; Prof. Isoda Masami, Japan; and Prof. Dr. Noor Azlan bin Ahmad Zanzali, Malaysia) and four invited speakers are from Indonesia (Dr. Ary Ginanjar Agustian, Prof. Jozua Sabandar, Ph.D., Prof. Dr. Sutarto Hadi, and Dr. Marsigit). We also very happy since we have numerous participants who are come from all parts of Indonesia and also from Malaysia. Alhamdulillah, there were 83 papers related to mathematics education that have been presented on parallel session of this conference.

We are very grateful to all reviewers who have been dedicated to review the articles of the proceedings. The reviewers are: Prof. Yaya S. Kusuma, M.Sc., Ph.D. (UPI Bandung), Prof. Jozua Sabandar, M.A., Ph.D. (UPI Bandung), Turmudi, M.Sc., Ph.D. (UPI Bandung), Prof. Sutarto Hadi, M.Sc., Ph.D. (UNLAM), Prof. Dr. Ahmad Fauzan (UNP), Dr. Rahmah Johar (UNSYIAH Aceh), Dr. Abdurrahman As'ari, M.A. (UM), Dr. Cholis Sa'dijah (UM Malang), Dr. Yansen Marpaung (USD Yogyakarta), Sukirman, M.Pd. (UNY), Dr.Marsigit, M.A. (UNY), Dr. Hartono (UNY), Dr. Djamilah B.W., M.Si (UNY), Dr. Sugiman (UNY), Dr. Ali Mahmudi (UNY), Dr. Agus Maman Abadi (UNY), Dr. Jailani (UNY), Dr. Dhoriva Urwatul Wutsqo (UNY)and Dr. Heri Retnawati (UNY).

The proceeding contains as many as 84 articles. The author of the article came from several institutions, namely: UNY, UTM Malaysia, UPI, UNJ, UNNES, UM, Unsyiah Kuala, PPs UNY, Sekolah Pascasarjana UPI, PPs UNJ, S2 Pengajaran Matematika ITB, UNIMED, UNHALU, UNSRI, UNRAM, Universitas Negeri Gorontalo, UNILA, UNS, Univeritas Tadulako, UIN Syarif Hidayatulloh Jakarta, STAIN Tulungagung, UII, UNISBA Bandung, USD Yogyakarta, Universitas Muhammadiyah Purworejo, STIKOM Surabaya, Universitas Muhammadiyah Bengkulu, Universitas PGRI Adi Buana Surabaya, UKSW Salatiga, Universitas PGRI Palembang, Universitas Widyadarma Klaten, STKIP Siliwangi Bandung, Universitas Veteran Bangun Nusantara Sukoharjo, STKIP Sebelas April Sumedang, SMA N 4 Tasik Malaya, Universitas Siliwangi Tasikmalaya, Universitas pelita Harapan Tangerang, SMA Lentera Harapan Lampung, UNIROW Tuban and IKIP PGRI Semarang.

We hope that the proceeding be useful, not only for the authors, but also can enrich the creative and innovative ideas that can support the advancement of mathematics education, especially in Indonesia.

Yogyakarta, May 2012
Chairman of the Committee
Dr. Ali Mahmudi

CONTENTS

P – 49

Developing Students' Character Through Mathematics Teaching And Learning

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Abstract

The National Education System mandates that the national education serves to develop and shape the character and civilization of the nation. This confirms the quality of Indonesia's human to be developed by each educational unit. This normative national education goals need to be elaborated and implemented in the teaching and learning process, including mathematics teaching and learning. Mathematics teaching and learning should be well designed so that it can be used as a tool in developing positive character of students. Through the mathematics teaching and learning, implicitly or explicitly, can be developed variety of positive characteristics, such as critical thinking skills, logical thinking skills, analytical thinking skills, or meticulous. Such mathematics teaching and learning needs to be done consistently so will lead to habituation to the students that if beyond a certain limit, it belongs to the students' habits and entrenched in him.
Key words: mathematics teaching and learning, character.

INTRODUCTION

Each individual faces a problem, in the narrow and broad-scale, simple or complex. Complexity of the problem is growing as the swift currents of globalization and increasingly complex challenges of life. Each individual requires capabilities and strategic character to succeed in solving various problems and face many challenges, the workplace and personal lives.

To succeed in the workplace and in personal lives, one does not only require technical skills, but also non-technical skills. The importance of the non-technical skills that are described by Beach (Tim Program Hibah Kompetisi Berbasis Institusi Universitas Udayana, 2010) which showed that as many as 87% of people fail or have lost their jobs because of unacceptable behavior.

One of non-technical skills that support the success of the individual is an individual character. Educational institutions have the responsibility to develop students character through teaching and learning process as mandated by National Education System which states that education serves to develop and shape the character and civilization of the nation. This confirms the quality of Indonesia's human to be developed by each educational unit. This normative national education goals need to be elaborated and implemented in the teaching and learning process, including mathematics teaching and

learning. Mathematics teaching and learning should be well designed so that it can be used as a tool in developing positive character of students. Through the mathematics teaching and learning, implicitly or explicitly, can be developed variety of positive characteristics, such as critical thinking skills, logical thinking skills, analytical thinking skills, or meticulous. Such mathematics teaching and learning needs to be done consistently so will lead to habituation to the students that if beyond a certain limit, it belongs to the students' habits and entrenched in him

DISCUSSION

This section describes the character and its development through mathematics teaching and learning.

1. Character Development

Each individual requires a certain competence for success in the workplace and in the personal lives. Based on their survey, Ruben and DeAngelis (Tim Program Hibah Kompetisi Berbasis Institusi Universitas Udayana, 2010) identified the necessary competence or character of an individual to succeed in the workplace and in the personal lives. These characters are personal, social and organizational characters. Meanwhile, according to Pulliam (2008), the competence of the most desired workplace are communication skills, interpersonal skills, high motivation/initiative, honesty, strong work ethic, work in teams skills, analythical thinking skills, flexibility and details oriented.

NACE USA survey results (Tim Program Hibah Kompetisi Berbasis Institusi Universitas Udayana, 2010) also mentioned the 14 characteristics of the individual to succeed in the workplace. These characteristics are communication skills, honesty/integrity, interpersonal skills, ethics, motivation/initiative, adaptability, analytical skill, technological literacy, organization skill, details oriented, leadership, confidence and friendly.

Tempo Data and Analysis Center (Tim Program Hibah Kompetisi Berbasis Institusi Universitas Udayana, 2010) also conducted a survey on the champion characters as presented in the following table.

Table 1. Job Seeker Characters Rating Required by Workplace

No	Champion Character	Percentage
1	Willing to work hard	9,03
2	High confidence	8,75
3	Having a vision for the future	8,37
4	Ability to work in teams	8,07
5	Having a good and detailed plan	7,91
6	Ability to think analytically	7,82
7	Adaptable	7,12
8	Able to work under pressure	5,91
9	Proficient in English	5,27
10	Ability to organize work	5,26

Various characters described above should be used as a reference in carrying out the teaching and learning that allows the growth of various student characters. It must be recognized if these characters are not developed optimally in the school. Indeed, it is not contained explicitly in the school curriculum. But, it should be understood that the curriculum is not just a compilation of a number of subjects. The curriculum is an educational plan to facilitate students a specific competence that has ben formulated (Buchori,2000). Supposedly, teaching and learning activities is designed and implemented to integrate the skills or characters.

2. Development of Character through Mathematics Teaching and Learning

Mathematics has a strategic role in the development of science and technology. But, not solely because it mathematics needs to be learned. Mathematics educators need to ask themselves: what is the purpose of mathematics teaching and learning? Is intended to make students master all mathematics materials as much as possible? Or, is that students become mathematician later? Of course not. Mathematics teaching and learning is not only intended to make students smarter, but also that the students have the good reasoning, personality and good character (Soedjadi, 1999). This is understandable, because not all students who receive math lessons in the end will continue to use or apply the mathematics they have learned. Though almost all students need good reasoning and personality in everyday life

Through mathematics teaching and learning students are expected to think logically, rationally, critically, honest, and have high integrity. These skills or characters are indeed higly required individu to be able to survive in competitive global era.

Students are not only prepared to have the skills associated with thinking and reasoning skills, but also prepared to have a personality, integrity and good character. It is easy to understand and be able to imagine what would happen to someone who has high knowledge and skills, but not based on high attitude and morality.

Are the characters as mentioned above can be developed through the mathematics teaching and learning? Mathematics teaching and learning that well designed can be used as a tool to cultivate a variety of characters. As an illustration, in mathematics, there are many definitions and theorems. Definition and theorem are basically an agreement that must be obeyed (Mardiyono, 2005). Can be predicted what would happen if the various agreements (the definition) and rules (theorems) is not referenced. Of course it will cause confusion.The consistent use of this agreement and the rules closely with the attitude and character. Thus, the mathematics teaching and learning has a great opportunity to develop attitudes and character of students. Various other characters such as rigor and critical thinking skills can be nurtured through the activity of problem solving activity in the mathematics teaching and learning. While, various of characters such as the ability to work in team, organize and appreciate the opinions of others can be nurtured through learning activities in math class discussion setting. Thus, mathematics teaching and learning can be used and functioned as a tool to develop the intelligence, skills and to shape the character of students.

In the context of mathematics teaching and learning, positive characters that can be developed is often termed a mathematical value. According to Bishop (1998), values in mathematics education is the deep affective qualities which education fosters through the school subject of mathematics. The values in the mathematics or in the mathematics education are an important component in the mathematics teaching and learning. These values can be learned by students either implicitly or explicitly in the mathematics teaching and learning. For example, through a series of problem solving activities, students are trained to be critical, careful, coherent, analytical, rational and efficient.

According to Taplin (2003), there are some values or characteristics that need to be learned by students. These characters include: (1) honesty, (2) behave in a completely true, accurate, efficient, healthy and frugal living, (3) peace, such as tranquility, contentment, patience, concentration, optimism, self-acceptance, discipline and confidence, (4) love, such as compassion, forgiving and tolerance, and (5)

nonviolence, like virtue, cooperation, respect for diversity, respect life, respect property, and pay attention to the ecological balance.

Aspects of characters that can be developed in the mathematics teaching and learning generally can be divided into two kinds, namely those aspects of character in education generally (also a growing generally in society) and aspects of character in mathematics (as well as in mathematics education). As an illustration, when teachers require students to act honestly in doing the test, then the values of honesty, good behavior, which is generally derived from the values of education in general, has introduced teachers to the students. Meanwhile, when students describe and compare several different proof of the Pythagorean theorem, mathematical values such as rationality, openness and accuracy has been introduced and trained to students.

Based on the above, actually to develop skills and positive character to students is not realized by giving certain new subjects, no need to increase the allocation of time, requiring no additional new teachers, but can be integrated into existing subjects. Learning democracy, for example, can be done through discussion activities and can also be attached substantially in certain mathematical material. For example, there are various definitions of a square that can be constructed by student. A square can be defined as a quadrilateral whose four sides are congruent and four right-angle. Square can also be defined as a rectangle whose sides are congruent. Also, square can also be defined as a rhombus whose right-angle. It can be emphasized to students that although it looks different, these definitions are the same in substance. This will train the students to appreciate other people's opinions and do not insist that only their own opinion right.

Here are given some examples of integration of the various characters in the mathematics teaching and learning. One way is through learning problem-solving activities. Problem solving is an important part and is one of the purposes of mathematics teaching and learning. Through problems solving activity, it is expected that students can develop critical and creative thinking skills. These skills are very important for students as a preparation for life’s challenges. Here is an example of problem that involves a lot of information that require students to sort out and use them in solving problems.

> Last week Adi traveled with a train as far as 1093 km. The train left at 08.00. After traveling 4 hours with an average speed of 86 km / h trains stopped at the next station for 1 ½ hours. Then the train traveled again for 3 hours with an average speed of 78 km / h to stop at the last station. How many kilometers the distance traveled by train?

To be able to solve problems like the above, students can not only use knowledge of their books. Students are required to be able to select relevant information that can be used to solve the problem.

Another way that can be used to develop the reasoning skills of students is by providing incomplete information in a problem. The problem is often referred to as Fermi problems (Taplin, 2003). By using the reasoning skills and experience, it is expected that students can obtain a rational answer to the problem. Problems like these would be better if resolved in the context of a group discussion or cooperative learning. Here are examples of Fermi problems that require students to have a concern for social issues.

- How many liters of gasoline are required in your city every day?
- How many dollars can be saved if the people using public transport than private vehicles?

Fermi problems can also be used to develop values or humanitarian character (Taplin, 2003). When a teacher will teach the topic of the value of money, he can first give a story about a child who was sad because it failed to persuade his parents to buy him an expensive sport shoes on his birthday. The boy felt his parents did not love her. His parents are so sad for that notion. They hope that their children understand the family's financial situation. They asked him, how much money must be spent for their needs? Unfortunately, the child can't give an answer. Based on the story, the teacher can ask a few questions to students like this.

- How much money spent by parents to meet your needs every year?
- How much money spent by parents to meet your needs up to now?

The questions are an open question that allows obtaining the various answers. It is expected that students realize that the money they receive from their parents is so great, something that sometimes they did not expect before. It is supposed to make students aware that his wishes do not always have obeyed others. It is expected to cultivate positive characters on students, such as efficient, emphaty, and care about the difficulties of others.

Teachers can also use non-routine problems to develop a variety of other positive characters. Non-routine problems can be used to encourage the development of logical thinking skills and develop problem-solving strategies that can be applied to other situations. Here is an example of non-routine problems that require higher-order thinking skills.

Specify a number that meets the following properties.

- If the remainder is 1 divided by 3

- If the remainder is 2 divided by 4
- If the remainder is divided by 5 is 3
- If the remainder is 6 divided by 4

One of the mathematical topics that can be used to develop caring attitude towards the environment and energy saving are statistics, especially the presentation of data. To begin the mathematics teaching and learning, teachers can ask students to predict the amount of paper they use every week. Use tables to present data obtained by the students. Ask students, whether they be surprised. Do they use too much paper? Why use a paper on certain days or weeks more than days/weeks of the others? Do they have a better idea to save paper? Is the paper saving campaign will succeed? Discuss students' responses. Students' answers can be used as a basis for developing the character of saving/ efficiency and care for the environment.

Another way that can be used to develop human values is to introduce to the students about the biography of mathematician. One well-known mathematician is Maria Agnesi (1718-1799). She was an Italian mathematician who has contributed greatly to the development of Calculus. As a child, she often helps other children learn, in addition to completing her own study. At the age of twenty, she began a book project titled Analytic Institution. Sometimes, she encountered problems in completing the book. However, her mind is always working, even when she sleeps. Ever, in a state of sleep, she walked to his desk to write something and then go back to bed. In the morning, she had found the answer to his problems. The book is written makes it famous. In this book, she proves that the statement had put forward when she was 9 years old. In addition to mathematics, she also has an interest in other fields. She was hanging out and working with the poor community in the area where she lived. In fact, she asked her father to make some room for a private hospital. She also worked in a hospital until she died at the age of 81 years. She often helps people who are not lucky and did not get a chance. This biography may be used as a means to develop a positive attitude on students such as diligence, perseverance and social emphaty.

Jumsai (Taplin, 2003) suggest an alternative way to develop the values or characters in the mathematics teaching and and learning, namely by developing questions that contain positive characters, or rewording problems that already exist. Through the questions referred, it is hoped the message conveyed to students about the desired positive behavior. Suppose given the folloeing problem.

Mr. Hasan has 35 cows. A thief took 14 of the cows. What is the number of Mr. Hasan's cow now?

The problem can be changed or reworded so that contain positive values as follows.

Mr. Hasan has 35 cows. He was very generous. He gave 14 cows to others who need it. What is the number of Mr. Hasan's cow now?

Messages to be delivered to students through these questions is the development of positive characters on students, such as generous, empathetic, helpful, and so forth.

A variety of positive character traits will be more effectively fostered in a social context, through class discussion. Students will be easier to reach an understanding on many mathematical topics if they are given the opportunity to work together in pairs or small group discussions.

CONCLUSION

Mathematics teaching and learning is well designed can be used to develop students' character as the critical thinking, creative thinking, logical thinking, to think coherently, to think systematically, and consistent in attitude, even to develop human values. The mathematical teaching and learning needs to be done consistently so entrenched in the student

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