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Prof. Dr. R. Asep Kadarohman, M.Si.
Dean of the Faculty of Mathematics and Science Education
Indonesia University of Education

MATHEMATICS CONTRIBUTION TOWARD DEVELOPING STUDENT CHARECTER VALUE

By
Dr. Saleh Haji, M.Pd.
Chairman of the Postgraduate of Mathematics Education Program
in Bengkulu University
Email adress: salehhaji25@gmail.com

Abstract

Curriculum 2013 emphasizes the importance of the students character. Mathematics as a deductive science can contribute to the developing of student character value. The character value are 1. Consistent, 2. Democratic, 3. Creative, and 4. Critical.

Keywords: Mathematics, Value Character

A. INTRODUCTION

2013 is the first year implementation of Curriculum 2013 in the schools. Curriculum 2013 is the development of the Education Unit Level Curriculum. Curriculum 2013 (Kemendikanas, 2013) is designed with the aim to prepare the Indonesian people that have the ability to live as individuals and citizens who believe, productive, creative, innovative, and affective and able to contribute to the life of society, nation, state and world civilization. This is consistent with the national education function to develop the character development and civilization of the nation's dignity in the context of the intellectual life of the nation, aimed at developing the potential of students to become a man of faith and fear of God Almighty, noble, healthy, knowledgeable, skilled, creative, independent, and become citizens of a democratic and responsible (UU Sisdiknas, 2003).

In addition to intelligence, curriculum 2013 and the national education goals also emphasized the importance of students character who are creative , critical , innovative , capable , independent , productive , democratic , and accountable . According Kesuma (2012) , the character is embodies a value in the form of behavior (attitude). Whereas the mean value of the value contained in the 2013 curriculum are needed by the students in their daily lives , the creative value is needed to form a creative attitude in solving many difficult problems. Innovative attitude needed to be able to produce new things . Independent values required in forming an independent attitude which not dependent on others in achieving a goal . Democratic values needed in shaping democratic attitudes that can express a variety of individual potential . While the value of responsibility is needed in shaping attitudes toward risk-taking and the action that does not easily blame others .

Mathematics as a science of thinking (deductive), which contains a variety of objects and rules contain a discussion of various values that can shape a good student character. According Soedjadi (1999/2000), the freedom to make the mathematics can be used in teaching as a vehicle for democratic attitudes, which can also be viewed as a valuable education. This paper will discuss the contribution of mathematics toward students character value in school.

B. Mathematics

Mathematics is a science that can be viewed from various aspects . When viewed from the aspect of reasoning , mathematics is the science of reasoning. Developed reasoning is deductive reasoning . Deductive reasoning is reasoning that assist humans in drawing conclusions from things that are common to the case of a special nature (Suriasumantri , 2007). According Soedjadi (1999/2000) mathematics is the science of logical reasoning . Similarly Suherman et al (2001) stated that mathematics as a deductive science . The following mathematical statement . If a, b € R , such that a + b = b , then a = 0 is obtained by proving that using a variety of special properties of Algebra (field axioms) . Suppose a + b = b , then (a + b) + (- b) = b + (- b). The statement biimplikasi with a + (b + (- b)) = b + (- b) (Nature A2) ↔ a + 0 = 0 (Nature A4) ↔ a = 0 (Nature A3) (Muhafzan). The activity theorem proving is an activity that is a decision of a general nature Algebra (field axioms) that are special. Kusno (2004) explains that the evidence is a logical explanation of the process that has been assumed, in the sense of what is to be proved, based on some specific evidence or axiomatic proposition that has been accepted as true.

Mathematics as the science of reasoning can build character values are critical, creative, consistent, democratic, and accountable .
Mathematics can be seen as the science of organized structures (Ruseffendi , 2006). As an organization, mathematics has many components that have their respective roles and be bound by the rules to achieve a goal. Mathematics has (1) the elements that are not defined , (2) the elements that are defined, (3) axioms/postulates, and (4) theorem. Elements that are not defined (primitive element) is the basic concept that builds mathematics . Primitive elements exist, but can not be expressed with an appropriate sentence (Ruseffendi , 2006). Some examples of the primitive elements are points, lines, arches , fields , and space. Then , the elements are not defined the building elements are defined. The elements are defined to ensure that the discussions do not lead to confusion in mathematics (Kusno , 2004). In addition , the elements of which are defined assure understanding of a concept in mathematics. Some examples of elements are defined as follows: angles, triangles, and simple closed arch. Angle is the set of points of the two beams are combined both its starting point association, but does not lie on the same line (Kusno , 2004). Based on the elements that are not defined and defined elements set various axioms (postulates). According Kusno (2004), axioms (postulates) are statements which constitute the fundamental laws whose truth is accepted without the need to prove. Ruseffendi (2006) distinguish between axioms and postulates. Postulates are basic assumptions in geometry, while the axioms are basic assumptions in Algebra. Examples postulates are two distinct points lie on one line (Kusno , 2004). While the axiom instance is a whole greater than its parts (Ruseffendi , 2006). Based on the elements that are not defined, the elements are defined, and axioms (postulates) testing various propositions to obtain a theorem . Theorem is a mathematical statement that has been proven to be true (Kusno , 2004) .
For example is a theorem, if a $\mid$ b then a $\mid$ cb for any integer c that proved by using elements that are not defined, the definitions and axioms. Element is not defined numbers. While the definition used is the definition of a depleted integer integer divide b is written (a $\mid$ b) and axiom used is added to the axiom about the same if the result is the same. Proof of the theorem is as follows (Sukarman, 2001) :
a $\mid$ b means there is an integer k such that b = ak (definition)
If both sides are multiplied similarities integer c is obtained:
cb = c (ak)
cb = a (ck)
Because c and k integers, then ck the integers too.
So cb = a (ck)
Means a $\mid$ cb.
Another example, mathematics as a science structured in proving the following theorem:
If two angles opposite to each other, then they are congruent.
Note: <BAC and <DAE conflicting.
Prove: <BAC and <DAE

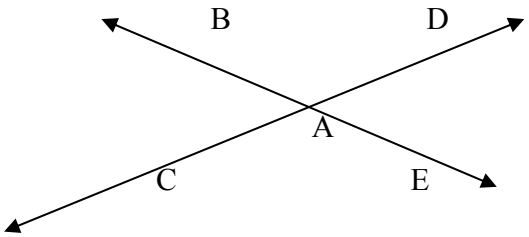

Figure 1 Two lines intersect

Proof (Kusno, 2004):
(1) <BAC and <BAD bersuplemen
Reason: Point C, A, and D line (definition). A, C, D term is not defined.
(2) u <BAC = 1800 - u <BAD
Reason: The number of angular size bersuplemen 180^0 (Definition)
(3) <DAE and <BAD bersuplemen
Reason: Point C, A, and D line (definition)
A, C, D collinear. A point between C and D (Axiom)
(4) u <DAE = 180^0 - u <BAD
Reason: The number of angular size bersuplemen 180^0 (Definitions)
(5) u <BAC = u <DAE
Reason: transitive properties
(6) So <BAC ≈ <DAE
Reason: Definition kekongruenan two angles.

The above description explains that mathematics as a structured knowledge built through elements that are not defined, the elements are defined, axiom/postulate, and theorem. Relationship of these elements is described Kusno (2004) as follows:

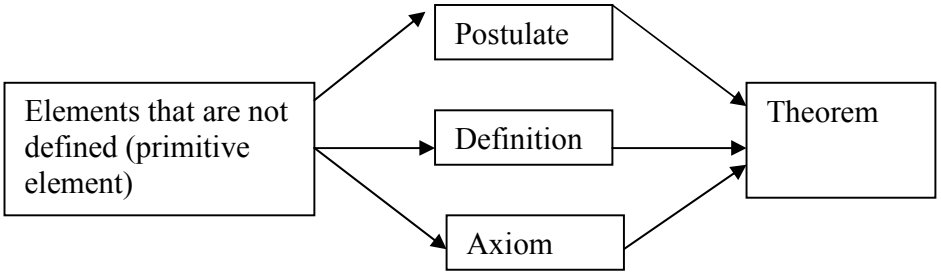

Figure 2 Mathematics System

Mathematics as a science that can form a structured character values obey the principle, consistent, and democratic.
Mathematics as a language. According Suriasumantri (2007), mathematics is a language that symbolizes the meaning of a series of statements that we want to convey.
Mathematics contains various symbols. The symbol implied message conveyed. Like the symbol "≤" which means "less than or equal to" symbol "≠" means "not equal to".
Mathematics as a language has several advantages compared to other languages. The advantages include: (1) the mathematical symbol has double meanings, such as "+"

symbol which means "number of operations", (2) saving (simple), like the symbol "s = vt" can be interpreted as "distance traveled by an object depends on the object's velocity and the time required to reach the distance", (3) develop a mathematical language that allows to perform numerical quantitative measurements, such as the symbol $Pt = P_0 (1 + \lambda t)$ where pt specifies the length of the metal on termparatur t (Suriasumantri, 2007).

Mathematics as a language can contribute to the formation of a consistent character value. So the use of symbols in the message has a fixed meaning in the any situations.
Mathematics as a science of patterns and relationships. This was stated by Suryadi (2012) which states that mathematics is the study of patterns and relationships. Mathematics contains many different patterns. As in determining the amount of shake that occurs in a group of people.

If there are 2 peoples, then the amount of shake that occurs 1 time $= \frac{2(2-1)}{2}$

If there are 3 peoples, then the amount of shake that occurs 3 times $= \frac{3(3-1)}{2}$

If there are 4 peoples, then the amount of shake that occurs 6 times $= \frac{4(4-1)}{2}$

If there are 5 peoples, then the amount of shake that occurs 10 times $= \frac{5(5-1)}{2}$

……
……

If there are n peoples, then the amount of shake that occurs $= \frac{n(n-1)}{2}$ times (Priatna, 2002)

Mathematics as a science of patterns can shape the character value of beauty.
Mathematics as a human activity. This was stated by Freudenthal in Haji (2012) that mathematics is a human activity. Mathematics activities include the construction of models, finding algorithms, discussion, and reflection.
Daily life problems and issues through a simplified mathematical model in the form of figures, tables or other representations. Completion of the model is done through discussion and reflection, that are found various concepts and algorithms. This is evident from the activities undertaken math students in the following Realistic Mathematics Learning.
Contextual Problem (Wijaya, 2012): Bus "Waspada" containing 12 passengers departing from Terminal "Kota" to Terminal "Pasar" through three stops. At Campus shulter a stop, 5 passengers up and down 3 passengers. At Simpang shulter, down 4 passengers and up 2 passengers. At School shulter a stop, up 7 passengers but no passengers were dropped. How many passengers who disembarked at Terminal "Pasar"?
Each student illustrates the situation about the model itself. There depicting the people and buses, some are describing with lines, circles and others. There are also write the following mathematical model.
12 + 5 – 3 -4 + 2 + 7 = ……..?

12 + 5 – 3 -4 + 2 + 7 = 19

So many passengers get off at Terminal "Pasar" there were 19 people (Wijaya, 2012)
Mathematics as a human activity can contribute to the formation of democratic values and responsible character.

Although mathematics can be viewed from various aspects, but the mathematics has its own characteristics. Soedjadi (1999/2000) describes the characteristics of mathematics as follows:

1. **It has the object of study abstract.**
   Mathematical study include are : facts, concepts, principles, skills, reasoning, problem solving, and communication. These studies contained in the human mind and are abstract. Examples of facts include numbers, dots, and dashes. Examples of concepts such as triangles, circles, and functions. Examples of principles such as equality, inequality, the Pythagorean theorem. Examples include conducting skills (algorithms) completion of an equality/inequality, system of equations/inequalities linear, matrix operations, and vector operations.
2. **Rests on the deal.**
   Various agreements among others in determining a set of symbols and elements that are not defined and defined elements. Examples symbol "Σ" to declare "number", "∫" to declare "integral". Determination of points, lines, and areas as elements that are not defined. Example of a function definition which means a set of ordered pair of numbers (x, y) where there are two different couples the same first number (Leithold, 1992).
3. **Deductive thinking patterns**
   Building mathematical mindset is based on the deductive thinking of the things that are common to the things that are special. Such as the Pythagorean theorem can be proven deductively, applies specifically to determine the length of one side if known lengths of the other sides in a right triangle.

4. It has an empty symbol meanings
   The symbols x, y, z .... in an equation as a variable that is empty of meaning. Similarly with other symbols in Abstract Algebra, such as: a * b = a + b - ab with a, b € R. Another example of the symbol Σ, ∫, and ≠.

5. See the universe of discourse
   Every mathematical statement applies only to a particular universe. Such as Pythagoras theorem applies only to right triangles that $c^2 = a^2 + b2$ where c length of the hypotenuse of a right triangle, a and b the length of the other bracket. Similarly, the definition of a function applies to the universe of real numbers.

6. **Consistent in his system**
   Structure of Geometry Euclid (Kusno, 2004) in the form [{Σ, r, Ω}, a1, a2, a3, a4, a5] where Σ as the set point, the set of lines r, Ω the set of fields and a1, a2, a3, a4, a5 are axioms. All the rules of Euclidean geometry in a consistent structure. Means there are no rules (theorem) in Euclidean Geometry conflicting.

C.Character Values in Mathematics

Value is the idea/concept of something that is considered important by a person in life (Fraenkel, 1977). One of the concepts that are important in a person's life is character . Kusuma (2012), the character embodies a value in the form of behavior (attitude) . Character consists are the honest, hard working, assertive, patient, resilient, cheerful, strong, open , visionary , independent , brave , courageous , reflective , responsibility ,

discipline (Kusuma et al , 2012). According Arry Gina in Kusuma et al (2012) , a wide - kind of character are honest , responsibility , visionary , discipline , cooperation , fair , and caring. Meanwhile, according to the Heritage Foundation in Indonesia Kusuma et al (2012), the value of the character that was developed is the love of God and all His creation, independence and responsibility , honesty/trustworthy and discreet , respectful and polite , generous , helpful and mutual assistance , self-confident , creative , and hard work , leadership and justice , good and humble , tolerance and peace and unity .

Some character values developed through mathematics are consistent, democratic, creative, a and critical .

1 . Consistent

Consistency in the use of symbols and applying various rules . Like the symbol " ∫ " to declare " integral " , " Σ " stated " sigma " , " 8 " states " number eight " and so on . These symbols are used in a variety of circumstances have the same meaning . Similarly in proving a theorem using the definitions and other theorems that have been proven to be true first. Consistent in applying the definition . As in the following theorem . If a group G , then apply (ab) -1 = b - 1 a- 1 . Proof of the theorem using the definition of an element of unity , the concept of equality , and associative properties of a group .

When a group is defined as a monoid (G , *) with unity element e in which every member of G x x - 1 are members of G such that x - 1 x = x x - 1 = e (Kromodihardjo , 1988) . Then (Z , +) with Z the set of integers and " + " added the daily operation of a group . While (A , +) where A First set of numbers is not a group because the group does not meet the definition .

Consistent character values contained in mathematics can be implemented in learning mathematics . Each student is expected to be consistent as learners are studying in school . Students need to be able to complete all their studies . Students to follow the activities of studying . Students carry out the rules of the school . Similarly , the teacher is consistent in its function as the person delivering science to their students . Teachers implement school rules and staffing . Teachers prepare , implement , and evaluate science and learning in accordance with applicable regulations . Consistency in implementing the various components of the school rules and functions will allow the school to achieve educational goals .

2. Democratic

Resolution of a problem in mathematics or in proving a theorem can be done in various ways . Everyone has the freedom to solve a problem in mathematics . As in solving a problem in the following system of linear equations .

To obtain the value of x , y , and z that satisfy the following system of linear equations can be done in various ways , such as " substitution , elimination , graphs , matrices and others.

$x + y + 2z = 9$
$2x + 4y - 3z = 1$
$3x + 6y - 5z = 0$

To obtain the value of x = 1 , y = 2 , and z = 3 which satisfy the system of linear equations can be done by elimination , substitution , elementary row operations and others. Anton (1988) solve a system of linear equations is by way of the following elementary row operations .

Every individual has the freedom to determine how to resolve the issue in accordance with the interests , knowledge and experience they have. Freedom it provides flexibility for individuals to develop their potential . Moreover , the freedom to provide comfort in work . Because individuals work in accordance with his pleasure .
Freedom possessed by mathematics can be implemented in the learning of mathematics in schools . Students have the flexibility to understand a concept in mathematics and in determining how to solve various math problems . Students have the freedom to determine how (style) study . Students have the freedom to determine the direction of interest. Similarly, the teacher , have the freedom in designing , implementing , and evaluating learning . Freedom of the students and teachers in the learning of mathematics will be able to create a fun learning mathematics.

3. Creative

Creative in mathematics demonstrated in solving a problem or proving a theorem or creating new ideas . According to Echols (2005) , creative means to have creativity . Such as creative in finding new methods to solve a problem .
Armed with a variety of existing rules , such as definitions , axioms , and theorems and things that are unknown in a problem, then the required creative people to solve a problem . As in the following troubleshooting . Mr. Karyo is a farmer . He wanted to use a woven wire fence in his garden . It has a 360 meter long woven wire . However , it requires that the wire fence that he can memagai widest garden . Garden to be fenced rectangular . What is the length and width of the garden Mr. Karyo (Turmudi , 2010) . Creativity that students can do to resolve the issue can use tables , equations , and derivatives or the other.
Creativity is needed to acquire new things better , easier , and more economical , and so on . Implementation of creativity in mathematics learning can be realized by students and teachers . Students use creative way to solve a problem . Creative use of props in understanding a concept . Similarly, teacher , creative in designing , implementing , and evaluating learning . Creativity can make the learning of mathematics became more developed and not boring .

4. **Critical**

Critical character is formed through the enforceability of any definition and use of the various rules in proving theorems in mathematics . A mathematical definition of the load ' intension ' and ' extension ' . Extension of a definition is the set that was revealed by the definition (Soedjadi , 1999/2000) . While intense relates the significance of a definition . Like a trapezoid can be defined as " the right trapezoid is a quadrilateral pair of parallel sides " or " quadrilateral happens if a triangle is cut by a line parallel to one side is a trapezoid " (Soedjadi , 1999/2000) . Intention to two definitions are the same , but different extensions . Criticality think the intension and extension of a view definition . So that the two definitions can be used in mathematics .
Another example in the understanding of the definition of the supremum and infimum of a real number below. Numbers say u € R lub (supremum) of the set S , if (i) u is the upper limit of S and (ii) u ≤ s for every s € S. Numbers w € R is said to limit the largest (infimum) of the set S , if (i) w is the lower limit of S and (ii) u ≥ s for every s € S (Muhafzan) . Criticality required when notice requirement is a number that is a member of R supremum and infimum .

Criticality is also required in solving a problem in mathematics . Resolve issues such as the reduction of the two variables x - y if known an equation in x and y ,
Jika $(3+4)(3^2+4^2)(3^4+4^4)(3^8+4^8)(3^{16}+4^{16})(3^{32}+4^{32})=(4^x-3^y)$, maka x-y = ….

$$(4^x-3^y) = (3+4)(3^2+4^2)(3^4+4^4)(3^8+4^8)(3^{16}+4^{16})(3^{32}+4^{32})$$
$$= (4+3)(4^2+3^2)(4^4+3^4)(4^8+3^8)(4^{16}+3^{16})(4^{32}+3^{32})$$
$$= (4-3)(4+3)(4^2+3^2)(4^4+3^4)(4^8+3^8)(4^{16}+3^{16})(4^{32}+3^{32})$$
$$= (4^2-3^2)(4^2-3^2)(4^4+3^4)(4^8+3^8)(4^{16}+3^{16})(4^{32}+3^{32})$$
$$= (4^4-3^4)\ (4^4+3^4)\ \ (4^8+3^8)(4^{16}+3^{16})(4^{32}+3^{32})$$
$$= (4^8-3^8)(4^8+3^8)(4^{16}+3^{16})(4^{32}+3^{32})$$
$$= (4^8-3^8)\ (4^8+3^8)(4^{16}+3^{16})(4^{32}+3^{32})$$
$$= (4^{16}-3^{16})\ (4^{16}+3^{16})(4^{32}+3^{32})$$
$$= (4^{32}-3^{32})\ )(4^{32}+3^{32})$$
$$= 4^{64} – 3^{64}$$

To obtain x = 64 and y = 64. Means that x - y = 0 (Susyanto, 2012). Criticality in solving the above equation is in manipulating and using various properties/theorems.
Critical character values needed to avoid mistakes and obtain a settlement of the problem correctly. Implementation of these values in the learning of mathematics as follows. Students to be critical in understanding the facts, concepts, and principles in mathematics. As well as critical in performing a mathematical calculation. Critical in understanding the enforceability of any definition. Critical in understanding the requirements of a concept/ principle. Critical in using the rules in proving a theorem. Similarly, the teacher, in teaching the critical math in detail and depth when explaining a concept or to prove a principle.

D.Conclusion and Suggestion

1. Conclusion

Mathematics as science contributes to the formation of character values consistent, democratic, creative, and critical. Consistent with the application of the rules in solving a problem. Democratic in use how to solve a problem. Creative in developing something new. Critical to avoid errors.

2. Suggestion

Suggestions to the users of mathematics as follows:
a. Learning oriented mathematics teacher and student character building consistent, democratic, creative, and critical.
b. Mathematics learning should be more humane with character-based.
c. Need to do research on character formation of students through the learning of mathematics.

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Dr. Saleh Haji , M.Pd. Lecturer and Head of Graduate Studies (S2) Mathematics Education Program in University of Bengkulu. Born in Jakarta on May 25, 1960 . The author has a wife Dra . Yumiati , M.Sc. (Finishing Doctoral Program in UPI Bandung) and have children Mardiyah Hasanati , S.Psy, M.Psy and Andi Taufiq Muliawan (Finishing law degree program at the University of Padjadjaran Bandung). Authors completed the S1 program in the Department of Mathematics Education Teachers 'Training College FPMIPA Jakarta (1985), S2 (Master) Mathematics Education program at Teachers' Training College Graduate Program IKIP Malang (1994), and S3 (Doctoral) program in Mathematics Education Graduate Program in UPI Bandung (2004). He has taught at the State Islamic University (UIN) Syarif Hidayatullah Jakarta , University Muhammadiyah Prof. DR HAMKA (UHAMKA) Jakarta and University Muhammadiyah Bengkulu (UMB). Other activities , as educational consultant at the Directorate of Kindergarten and elementary school , the Directorate General of Primary and Secondary Education , Department of Education in 2006-2007 and Bengkulu Provincial Education Department in 2005. Authors as detaser (consultant) Higher Education Department of Education at the University of Science and Technology Jayapura (2008) and the University Darussalam Ambon (2009) .