CHARACTER EDUCATION MODEL THROUGH FACE-TO-FACE TUTORIAL FOR MATHEMATICS COURSE AT UNIVERSITAS TERBUKA

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ABSTRACT

Character education needs to be integrated into every course in the Primary Teacher-Training Programme at Universitas Terbuka. This paper describes the development of a character education model which motivates the students of Universitas Terbuka to develop positive characters in mathematics course tutorials. The research subjects comprised 48 students from the second semester of 2012 academic year. The model consisted of Tutorial Activity Plans, Tutorial Activity Units, Student Worksheets, and Evaluation Plan. The research instruments used were students' activities observation sheet, tutor's activities observation sheet, character model assessment sheet, students' questionnaire, audio-visual recorder, and field notes. The research results showed that the model met the criteria of validity, effectiveness, and practicality. The model encouraged the students to develop selected characters during the tutorial activities. Selected characters include: passion, habit of persistence, diligence, self-directed learning, confidence in unfamiliar situations, ability to collaborate in team work, active in tutorial, and ability to listen. In addition, the model assisted the students to actively construct an in-depth understanding of mathematics concepts.

Keywords: character education, collaborative learning, mathematics course, problem solving, tutorial

INTRODUCTION

The Universitas Terbuka (UT) regional centre in Yogyakarta is one of UT's branch offices located in Central Java. It is a part of UT's operations where learner support is provided to facilitate student learning activities in the form of tutorials, counselling, study groups as well as administrative services. A variety of tutorial methods are available in UT, namely face-to-face, correspondence, broadcast and online tutorials. Face-to-face tutorials are provided and facilitated by regional offices.

This paper highlights an example of the efforts taken by the Yogyakarta regional centre in delivering face-to-face tutorials for mathematics courses under the Primary Teacher-Training Programme (PTTP). Mathematics tutors in this programme are expected to integrate character education in planning and execution of the course in line with the aim of the university. Character education is a concept of developing moral consciousness in students (Lickona, 1999). It can be applied not only in social science courses, but also into exact or science courses, including mathematics courses. This concept can be integrated into the day-to-day teaching and learning process. According to Greenberg et al., (2003), education can help students to have knowledge, skills, care, responsibility and diligence.

LITERATURE REVIEW

Education is expected to motivate students to reach higher dimension in learning such as thinking critically and creatively, and to have positive attitude (Marzano, Pickering, & McTighe, 1993). Specifically, mathematics education aims to develop characters such as thoroughness, diligence, hard worker, curiosity, persistence, and creativity (Kemendiknas, 2010); and values such as accuracy, clarity of thought, ability to predict, consistency, creativity, effective organisation, happiness, flexibility, openness of mind, determination and working systematically (Dede, 2006). There are targeted characters in the subject area of mathematics itself such as rationalism, objectives, control, progress and openness. These characters are useful in life. Some of these characters were considered in the implementation of the character education model in this research. Mathematics education involve solving mathematical problem. A mathematical problem is defined as a problem where the solution cannot directly be seen by the students (Polya, 1973; Posamenteir & Krulik, 2009). Students need to integrate their understanding of that problem, their knowledge, and their experience in order to solve the problem (Mairing, Budayasa, & Juniati, 2011). Mathematical problems include isomorphic problems which are problems that have some structure but different in content (Sternberg & Sternberg, 2012). Students with good ability in solving such problems tend to have higher order thinking and positive characters (Mairing et al., 2011; Marzano et al., 1993). Critical thinking and creative thinking are also important in such efforts (King, Goodson, & Rohani, 2016; Krulik, Rudnick, & Milou, 2003). Thinking creatively in learning mathematics means thinking towards solving mathematics problems (Krulik, et al., 2003; Siswono, 2008). By exercising critical and creative thinking, students can learn mathematics effectively.

Methods such as problem-based learning and cooperative learning which stresses on the use of problems in mathematics urge the students to work in heterogenic groups. Impact of these kind of learning is that the students are able to develop the attitude of respecting, listening, arguing and cooperating for similar purpose (Florida Department of Education, 2010; Ministry of Education, 2006). Some research showed that the characters effect students' achievement and students' ability to solve a problem (Pimta, Tayruakham, & Nuangchalerm, 2009). Characters are important not only in learning mathematics but also in day-to-day life and in workplace. Success in day-to-day life and in workplace is affected by characters of passion and persistent (Liputan6, 2017). Students develop characters by practicing in everyday situations as well as in classrooms. In a mathematics class, student can develop certain characters by solving mathematical problems (National Council of Teachers of Mathematics [NCTM], 2000). Students need to integrate their knowledge in each problem-solving phase by understanding the problem, developing plans, carrying out the plan, and looking back (Polya, 1973). If students do not have the problem-solving scheme, they will have difficulties in solving a problem (Mairing, 2014). They should read the problem more than once, represent the problem using graphs or pictures and try solving it. They could learn concepts and solutions from text books and try to solve the problems again. The process enables them to acquire a persistent character (Mairing et al., 2011).

The objective of this study is to develop a character education model which meets validity, effectiveness, and practicality criteria in motivating UT's students to develop positive characters during their mathematics tutorial sessions. The model stresses on learning problem-solving collaboratively in team work. The targeted characters are: passion, habit of persistence, diligence, self-directed learning, and confidence in unfamiliar situations, ability to collaborate in team work, ability to listen, and active in tutorial. (Mairing, Budayasa, & Juniati, 2012; Ministry of Education, 2006; NCTM, 2000).

RESEARCH METHOD

This study uses quantitative and qualitative approaches to develop a character education model through mathematics courses and to test the model on selected students. The research subjects were PTTP undergraduate students from Jetis learning centre at the Yogyakarta Regional Centre from 2012/2013 academic year who took the Mathematics course (PDGK4108). There were 24 students in class A and 24 students in class B. The research was conducted from August to December 2012.

Plomp (1997) introduced five phases in developing a tutorial learning model. The phases were early investigation, design, realisation/construction, test, evaluation and revision, and implementation phases (Figure 1).

In the early investigation phase, the characters that were needed to be developed were mapped through questionnaires and interviews. The characters mapped are the ability to collaborate, the ability to ask or answer the questions, and to share ideas, the ability to listen to the thoughts of other students' and the ability to undertake self-learning. Students need for high motivation in attaining these abilities is recognised in this study. Motivation itself is one of the factors in determining the student's learning success (Schlechty, 2001; Woolfolk & Margetts, 2007).

Design phase include preparation of the tutorial kit which consists the tutorial activity plan (TAP), tutorial activity unit (TAU), students' worksheets (SW), and evaluation plan (EP). TAP and TAU contain learning methods that are used in the tutorial activities. SW contains questions, assignments, and problems which require collaboration with other students. EP contains item test and mathematical problems which can encourage the students to have an initiative to solve the problems. The implementation of a tutorial kit can motivate the students to have the habit to think productively and to have positive character (Pimta, Tayruakham, & Nuangchalerm, 2009). In addition, syntax tutorial, classroom setting, learning media, reaction principle, role of tutor and students during tutorial activities, and appropriate research instruments were also designed. The syntax is designed to urge the students to develop desired characters. Reaction principle which is a description of how a tutor intervenes and responds to the behaviour of students during tutorials was also incorporated.

In the realisation/construction phase, the researchers developed the first prototype (Draft-1 Model) of the model and research instruments. The first prototype contained TAP, TAU, SW and EP. The instruments were students' activities observation sheet (SAOS), tutor's activities observation sheet (TAOS), character model assessment sheet (CMAS), students' questionnaire, audio-visual recorder, and field notes.

In the test, evaluation and revision phase, three experts assessed the implementation of the Draft-1 Model. The experts comprised a tutor, a mathematics expert, and a mathematics education expert. They also assessed the validity and the practically of the model and the criteria for measuring the effectiveness of the model. Based on the experts' suggestions, the researchers then revised the Draft-1 Model. The revised model is referred to as Draft-2 Model.

In the implementation phase, the researchers implemented the Draft-2 Model to the research subjects. The researchers evaluated the effectiveness, and practicality of the Draft-2 Model. The evaluation results were used to improve the Draft-2 model into its final form, the Character Education Model.

The instruments used for collecting the data were:

(1) The character model assessment sheet is used to determine whether the data meet all the validity criteria. (CMAS)
(2) The tutor activities observation sheet is used to determine whether the data meet the practicality criteria. (TAOS)
(3) The students' activities observation sheet, the field notes, the students' questionnaire, the students' worksheets, and the recorder are used to determine whether the data met the effectiveness criteria. (SAOS)

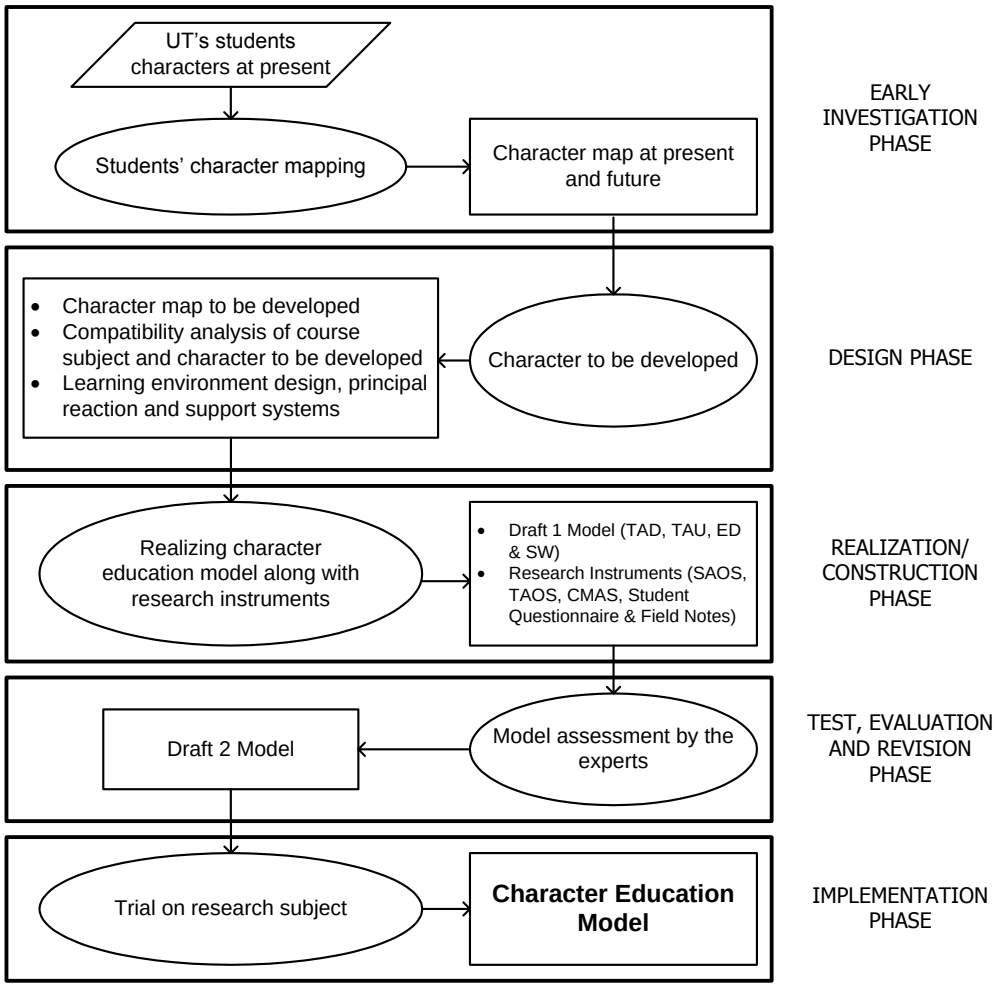


Figure 1: Character Education Model Development Procedure

RESEARCH FINDINGS

The Early Investigation Phase

Before developing the model of character education, current characters of the students were mapped by using information from the questionnaire. The results showed that 54% of the students could not collaborate as a team, 54% of them were not active in tutorial activities, 63% of them could not listen to other students' thoughts, and 65% of them did not have the self-learning ability. Therefore, the researchers developed a character education model that helped the students to acquire the characters and the ability to collaborate in a team, to be active in tutorial activities, to listen, and self-learning. The blueprint of the education model was designed in the following phase.

Design Phase

Results from the previous phase was used to design the blueprint of the education model and the tutorial kit to enhance students' skills in self-directed learning. The learning activities were based on collaborative learning methods to enable students to actively participate in class activities and give them the chance to explore their teamwork abilities. If these abilities are constantly exercised, they will shape students' disposition in learning. This positive disposition when continuously developed will become the constructive character among the students. The development of the draft-1 model in SW used discovery learning method in collaboration learning setting.

In general, the activities used in developing character in mathematics course tutorial were as follows:

(1) The tutor motivated the students before they learn a new concept. This was done by linking the concepts to be learned with their daily activities or with things that were already in students' memory. The tutor asked students about previous concepts related to the concept to be learned.
(2) The tutor explained the goal of the tutorial and teamwork that needs to be exercised in the tutorial activities.
(3) The students were required to find the concept in SW in groups. A group consisted of 4 or 5 students. The tutor help the students to understand the concepts. In the beginning, the tutor's role will be more dominant than the students' role. However, the tutor's role became less dominant in subsequent tutorials.
(4) In every worksheet, the tutor provided exercises to the groups to reinforce their understanding.
(5) Representatives from each group explained their answers in front of the class. The tutor helped to facilitate the discussions following the presentation in order to provide the students with conceptual knowledge.
(6) Students concluded their exercise under guidance of the tutor.
(7) Lastly, the tutor discussed the plan for the next tutorial.

Realisation/Construction Phase

In this phase, the designed (Draft-1 Model) model was put into practice. Firstly, the tutor motivated the students to learn the materials by explaining the benefits and the goal of the tutorial. Secondly, the tutor encouraged the students to exercise their teamwork abilities. Thirdly, the students learned from the examples in SW by attempting to answer the questions. The questions guided the students to make abstractions to find concepts.

Test, Evaluation, and Revision Phase

Draft-1model was assessed by three experts using the assessment sheet which consist the following indicators: clarity of the tutorial objectives; appropriateness of the model with mathematics contents, tutorial characteristics, nature of UT's students, and constructivist theories; appropriateness of language; and duration. The results show that the character education model fulfil the validity and practically criteria and could be used in mathematics course tutorial activities. There were some improvements suggested by the experts such as revising some sentences and clarifying some mathematical concepts for the model to be more appropriate with the expected characteristics and competencies. The Draft-1 model was then revised into the draft-2 character education model which was used in the tutorial activities.

Implementation Phase

Draft-2 model was implemented during the mathematics course in class A and B at Jetis, Yogyakarta. The tutorial was observed by two observers using the observation form. Observation results showed that 96% of the students from class A and 86% of the students from class B did the activities during the tutorial. Some students did not actively participate because they were not familiar with the syntax of the character education model used in the tutorial. The character education model fulfilled the effective criteria whereby at least 60% of students actively participated in tutorial the activities.

Students showed that their self-directed learning characteristics enhanced as they attempted to search for information from SW or mathematics learning materials. The students showed that the confidence character in learning mathematics by asking and/or answering the questions and presenting their group discussion results in front of the class. The student presenting their work is expected to have high self-esteem. Thus the character education model fulfilled the effective criteria. This observation is supported by field-notes indicating that the students were enthusiastic in group and class discussions and showed positive characters. These were in line with the tutor's observations whereby 100% of the tutor activities planned on SAT were executed in tutorial activities for every session. The model was found to fulfil the practical criteria as well.

The implementation of the character education model in mathematics tutorial courses showed that the students could find concepts independently. For example, in the concept of logic, students could find truth conjunction table, disjunction, implication, bi-implication table and the negation from the examples in SW. An example of the truth table completed by students independently can be seen in Figure 2 where B = True and S = False.

p	q	$p \wedge q$
B	B	B
B	S	S
S	B	S
S	S	S

Figure 2: An example of the Truth Table completed by the students

When a student can discover the concept and relate it to other concepts, it will last longer in the students' mind (Skemp, 1982) and help them to understand the concept much better (Sutawidjaja & Afgani, 2011). This is in line with the research result from Prastiti, Mairing and Juniati (2011) where the discovery method with explorative discussion can encourage students to play an active role in getting deeper understanding regarding the materials provided.

A student who understands the concept very well will have a greater ability to learn something new (Sutawidjaja & Afgani, 2011) as well as in solving a mathematics problem (Hudojo, 2005). This helps the students to acquire the characters of passion, habit of persistence, and diligence by learning to solve mathematical problems in the SW (Florida Department of Education, 2010; NCTM, 2000). This is reflected in the ability of the students to solve the truth table in Figure 3 and in the ability of the students to discover definitions from SW in Figure 4.

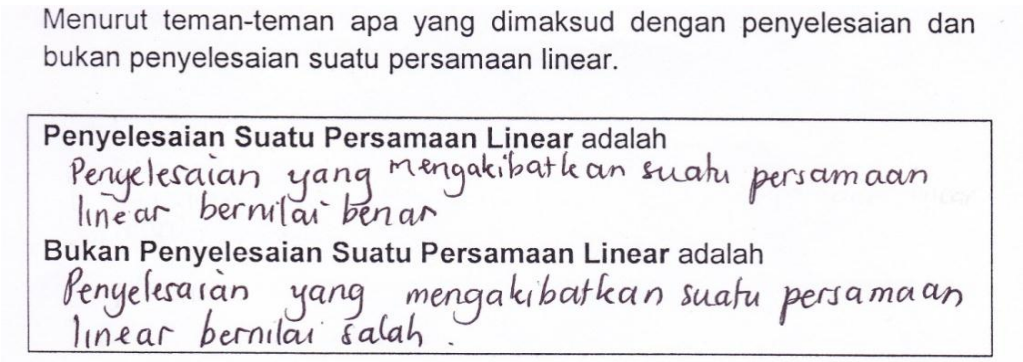
3(a) $(p \Rightarrow q) \vee (p \wedge q)$.

p	q	$p \Rightarrow q$	$p \wedge q$	$(p \Rightarrow q) \vee (p \wedge q)$
B	B	B	B	B
B	S	S	S	S
S	B	B	S	B
S	S	B	S	B

3(b) $-p \Rightarrow (p \Rightarrow -q)$

p	q	$-p$	$-q$	$p \Rightarrow -q$	$-p \Rightarrow (p \Rightarrow -q)$
B	B	S	S	S	B
B	S	S	B	B	B
S	B	B	S	B	B
S	S	B	B	B	B

Figure 3(a) and 3(b): Examples of problem solving by students


Menurut teman-teman apa yang dimaksud dengan penyelesaian dan bukan penyelesaian suatu persamaan linear.

Penyelesaian Suatu Persamaan Linear adalah
Penyelesaian yang mengakibatkan suatu persamaan linear bernilai benar
Bukan Penyelesaian Suatu Persamaan Linear adalah
Penyelesaian yang mengakibatkan suatu persamaan linear bernilai salah.

Translated version:

The question is "What does it mean by a solution and a non-solution in a linear equation ?"

These are students' response on the questions.

A solution has an impact that a linear equation has a value of true.

A non-solution has an impact that a linear equation has a value of false.

Figure 4: Original and translated example of definitions discovered by students in SW

The findings described show that the effectiveness criteria were fulfilled by the students during their tutorial activities. The Character Education Model proved to meets all the criteria set.

In revising the Draft-2 Model upon its implementation, there were problems in SW that the students had difficulty solving, the tutor guided the students by asking metacognitive questions at each problem solving stage. These stages were then reviewed to understand the problems that had occurred. The difficulties were resolved by revising sentences and improving the clarity of the problems given. Some sentences were added in SW to help the students discover the concepts. The revised model is referred to its final form, the Character Education Model.

Collaborative learning in this model was found to motivate students to exercise teamwork abilities such as (a) responding thank you utterances (b) listening carefully (c) giving compliment-responding compliments (d) waiting/trying patiently (e) asking for help/giving help (f) prompting other students/participation/responding to participation impetus (g) asking questions/responding to questions (h) appropriate interruption/accepting interruption (i) inviting group to come back to assignment. In general, this model encouraged students to develop the following positive characters in a mathematics course tutorial: passion, habit of persistence, diligence, self-directed learning, confidence in unfamiliar situations, ability to collaborate in team work, active in tutorial, and ability to listen. The atmosphere where students reflected, shared their ideas to others, draw the conclusion and presented the results in front of the class, was seen engaging. Such scenario encourages students to become independent learners (Sutawidjaja & Afgani, 2011; Mairing et al., 2011).

CONCLUSION

The Character Education developed in this study meets the criteria of validity, effectiveness and practicality. The model encouraged students to develop positive characters in the tutorial activities (passion, habit of persistence, diligence, self-directed learning, confidence in unfamiliar situations, ability to collaborate in team work, active in tutorial and the ability to listen). The model developed the students' ability in solving mathematical problems, and to achieve dimensions of learning (productive thinking, and positive attitudes. The productive thinking were critical thinking and creative thinking). The model could encourage students to construct mathematical concepts meaningfully and to solve mathematical problems. The ability to solve problems encouraged the students to have critical thinking and creative thinking. Although the model was developed specifically for a mathematics course, it is proposed that this model can be used for other courses.

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