International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 03, 2020
ISSN: 1475-7192

THE EFFECTIVENESS OF THE MODEL OF MEANINGFUL TEACHING INTEGRATING CHARACTER EDUCATION IN IMPROVING ATTITUDE AND MATHEMATIC PROBLEM SOLVING ABILITY

[1]Salamia, [2]Achmad Dardiri, [3]Heri Retnawati

Doctoral Program in Educational Science, Yogyakarta State University, Indonesia
*Corresponding Author: salamia0013pasca2016@student.uny.ac.id

Abstract: The implementation of the Model of Meaningful Teaching Integrating Character Education (MTICE Model) supports one of the educational programs in Indonesia, which requires the learning environment integrated with character education in all subject matters. The main objective of the MTICE Model is to enhance students' active involvement in teaching-learning processes and simultaneously to improve their mathematics learning achievement. This research aims to investigate the effectiveness of the MTICE Model in improving students' attitude and mathematic problem solving ability. It is a quasi-experiment involving one control group and one experimental group. The control group was taught by using the conventional teaching model, while the experimental one was taught by using the MTICE Model. The research sample of *madrasah tsanawiyah* (MTs), established using the convenience sampling technique. The data were collected using a mathematic problem solving ability test and student attitude questionnaire. The data were analysed using the One-way ANOVA at the significance level and the finding shows that the implementation of the MTICE Model is effective in improving students' learning achievement in attitude and mathematic problem solving ability. Therefore, it is suggested that the MTICE Model be used in mathematics teaching-learning processes.

Keywords: Meaningful Teaching, Character Education, Attitude, Mathematic Problem Solving

1. Introduction

The goal of Indonesian national education is to develop the potential of the students in order to have faith and to devote to the One and Only God, to have noble character; to be knowledgeable, healthy, smart, independent, creative, responsible, and to be democratic citizens thus explained by law. This goal shows that it is insufficient to equip Indonesian students only with strong cognitive and psychomotor competence but also with positive attitude. Productive young and highly spirited generation can be produced through quality education – intellectuality education integrated with holistic-comprehensive character education (Rukiyati, 2013). For this reason, the development of cognitive, psychomotor, and attitude competence must be integrated in educational processes (Zurqoni et al, 2018). Cognitive, psychomotor, and attitude competence development can be obtained through meaningful teaching because in its implementation, meaningful teaching integrates learning achievement in cognitive, affective, and psychomotor domains (Jonassen, 2006), (Hossain & Tarmizi2013). Effects of cooperative learning on students' achievement and attitudes in secondary mathematics. *Procedia-Social and Behavioral Sciences*, *93*, 473-477.. This is in line with the goal of Indonesian National Education, i.e. balanced learning achievement in cognitive, affective, and psychomotor domains. Developing a positive attitude can be done through character education (Zurqoni et al, 2018). The education curriculum currently applied in Indonesian schools is the revised edition of Curriculum 2013 (C13). In its implementation, C13 requires that the students make balanced learning achievement in cognitive, affective, and psychomotor domains. The implementation of C13 in the affective domain emphasizes the development of students' positive attitude.

Mathematic problem solving ability is important and needed by students in learning, evaluating, and solving mathematic problems; encouraging to share ideas, discuss with peer groups, and transfer experience to different situations as an effort to achieve educational objectives (Bostic et al, 2016), (Santos-Trigo & Reyes-Martinez, 2019), (Ahdhianto et al, 2020). For this reason, mathematic problem solving ability as cognitive learning outcome of high school students needs improvement (Ahdhianto et al, 2020), (Effendi, 2012).

[1]Student, Doctoral Program in Educational Science, Yogyakarta State University, Indonesia
[2]Professor, Doctoral Program in Educational Science, Yogyakarta State University, Indonesia
[3]Professor, Doctoral Program in Educational Science, Yogyakarta State University, Indonesia

Students' character building is expected to maximize their potential, enhance their learning motivation, maximize their self-potential, love their country, and able to respond to the challenge of globalization era (Tim Pusat Penilaian Pendidikan, 2019). For this purpose, character education is important to conduct because the young generation is experiencing life with many negative effects on the sustainability of their lives, such as the mass media (Pala, 2011), (Kosim, 2012), (Sahroni, 2017). Besides, character education is a way of assuring that students have a good character in their lives and improve their academic achievement (Lickona & Davitson, 2005). The implementation of character education in formal education is effective in resolving anarchic phenomena, student brawls, narcotics distributor and user proliferation, environmental crises, moral crises, and other social tendencies (Islam, 2017). Therefore, character education has been an important world-wide issue because the impact of its implementation is very significant on student academic and behavioural development (Alfarisy & Baptist, 2017), (Salafudin, 2013).

Character education is not an independent subject in the structure of the school curriculum applied in Indonesia nowadays. For this reason, C13 includes character education explicitly in the Basic Competency, which the teachers have to apply in teaching processes. This policy is supported by(Republik Indonesia, 2017) on character education strengthening program (CESP), which is the school movement to strengthen student character through the harmonization of literacy, esthetics, ethics, and kinesthetics by involving the public and cooperation among school, family, and community (Tim Pusat Penilaian Pendidikan, 2019). Character education in all levels of education must be integrated in the educational curriculum (Alfarisy & Baptist, 2017).

Mathematics instruction not only focuses on the cognitive competence, it is also responsible for developing students' character. For this reason, the integration of character education needs to be applied in mathematics teaching processes (Suyitno, 2019), (Nursanti et al, 2016), (Furqon, 2010). Mathematics teaching that integrates character education can be done by inculcating character values into teaching-learning activities from the planning, implementation up to the evaluation by using a selected teaching model (Fardian, 2011), (Marzuki, 2015). The character values which can be developed in mathematics teaching include, among others, discipline, honesty, justice and wisdom, positive thinking, perseverance, logic, rationality, being critical, and creativity (Furqon, 2010), (Irfan, 2017), (Nursanti et al,2017).

Previous related studies reported that character education integrated into mathematics teaching was quite effective in improving mathematics learning achievement and inculcating charter values in the students (Salafudin, 2013), (Hudha et al, 2014), (Susanti et al, 2012), (Falkenberg & Noyes, 2010). Improving the skill to get better academic achievement is part of character development (Falkenberg & Noyes, 2010). Moreover, the knowledge directly obtained through experience significantly affects attitude/behaviour (dewey, 2001).

Meaningful teaching enables students to understand the relationship between two or more ideas, both the old and the new ones (Ivie, 1998). In addition, meaningful teaching has impacts on problem solving concepts, critical thinking, collaborative learning, independent learning, and creativity. It improves affective experience which underlies the integration of thinking construction, feeling, and the act which leads to commitment and responsibility, and it becomes the basis of creative thinking (Novak, 2010), (Novak, 2011), (Novak, 2013). For this reason, in its implementation, meaningful teaching requires the students to construct knowledge and solve problems independently. Therefore, problem-solving-based teaching is most appropriate to apply in mathematics lesson, because it can make students solve contextual problems related to mathematics subjects so that it can improve students' understanding (Kaharuddin, 2018).

The findings of the afore-mentioned studies show that theoretically meaningful teaching has been integrated with character education values, yet it needs further investigation to see how far it affects the process, attitude development, and mathematic problem solving ability of the students in Indonesia. Teachers have to attempt to develop a positive attitude toward mathematics so that their students will not have a negative attitude toward mathematics teaching. They give opportunities to students to develop personal connection with mathematics so that they admire mathematics knowledge. The personal objective to master mathematics knowledge will encourage active participation in learning and getting in-depth understanding, so as to result in long-term knowledge to be used in solving the problems they face. The science research of Neuro revealed that there was a relationship between joyful participative teaching and long-term memory (Willis, 2010). Building in-depth and long-term understanding is the core of meaningful teaching. In-depth and long-term understanding is an important capital to support the ability to solve mathematic problems because mathematical concepts are interrelated with one another.

If a class has the culture of appreciating students in constructing their mathematic understanding themselves, they will have the opportunity to become successful mathematics students (Allen & Johnston-Wilder, 2004). The highest learning outcome can be achieved when the teachers are committed to improving their teaching quality for the sake of their students (McLaughlin & Talbert, 2006). Therefore, teachers should try hard to select a meaningful teaching model by putting emphasis on how students learn individually in order to obtain quality learning result.

This research implemented the Model of Meaningful Teaching Integrating Character Education (MTICE Model) in teaching mathematics in the classroom. The character education values integrated in the teaching process have been stated in the lesson plan. The chosen character values include patience, politeness, discipline, honesty, collaboration, responsibility, perseverance, self-confidence, curiosity, activeness, carefulness, bravery, critical thinking, and creativity. During the teaching-learning processes, the students showed the attitude according to character values stated in the lesson plan.

The aim of this research is to investigate the effectiveness of the implementation of the MTICE Model in improving the mathematic problem solving ability and attitude of the students. The research questions are as follows.

1. Is there any difference between the average score in the problem solving ability pre-test and posttest of the students in the experimental group and that of those in the control group?
2. Is there any difference between the average score in the pre-nontest and post-nontest in attitude of the students in the experimental group and that of those in the control group?

2. Literature Review

2.1 Meaningful Teaching

The learning quality and learning achievement are the responsibility of a teacher through creating meaningful learning experience and facilities for his/her students to achieve maximum learning outcome (Suyitno, 2019). In addition, success in learning also highly depends on students' involvement through teachers' guidance (Lestari, 2015). For this reason, teachers should change their teaching paradigm, in that they no longer consider students as the objects of teaching but as the subjects of teaching and that they no longer become the highest authority of knowledge and indoctrinator but they become facilitators who facilitate students to construct knowledge (Gazali, 2016).

Meaningful teaching is a mechanism/system which can facilitate the acquisition and storage of new information, as long as the knowledge in the students' cognitive structure functions as the frame/foundation for new knowledge (Silva et al, 2013). A meaningful learning process is the relation or interaction between new knowledge in the cognitive structure the students already have and the new materials they are being taught, which will form a new and more stable knowledge structure (Ausubel, 1961), (Kinchin & Hay, 2005), (Degeng, 2013). Meaningful teaching is relational in nature because it depends on the relation between previous knowledge and new information or new materials. This means that meaningful teaching highly depends on students' ability to remember the previous knowledge they already have and they have to try hard to relate it with new information or materials in order to add their knowledge. The previous knowledge (cognitive structure) has to be obvious, stable, and able to be related to the new information or materials.

The requirement for meaningful teaching to occur, among others, is that the students have to have relevant initial knowledge (cognitive structure), choose meaningful learning, and be aware of and deliberately relate new knowledge and relevant cognitive structure which is already known (Ivie, 1998), (Novak, 2013), (Zurita et al, 2015) . For this purpose, meaningful teaching must certainly be supported by teachers and students. The teachers are ready to help or to be the facilitators of the students for meaningful teaching and the students have the intention to do meaningful learning. More specifically, the characteristics of meaningful teaching include the teaching which is active, constructive, cooperative, authentic, and purposeful (Jonassen & Strobel, 2006), (Sailin & Mahmor, 2018). In its implementation, meaningful teaching will show meaningfulness in teaching processes: (1) the students actively involve in activities; (2) the students experience the transfer of knowledge, attitude, skill etc; (3) the teaching is authentic, joyful, related to outside real world; (4) the teaching is in line with stages of development and competence, and it values students' characteristics; and (5) the teaching facilitates students to learn to get knowledge by themselves, and determine the source, media, and ways according to their interest and needs (Marsigit, 2016).

Teachers play a very important role in creating meaningful teaching in the classroom. Mathematics teachers must create an interesting, unthreatening teaching environment in the classroom in order to help students develop the positive attitude toward mathematics subject, and learn it without constraints so as to improve their performance (Mensah, Okyere & Kuranchie2013). There needs to be a shift in teachers' perspective to the

characteristics and values of mathematics which should be included in the goal of mathematics teaching. Teachers should form teaching practice communities to develop personal autonomy of the students in order that they know, create, and understand mathematics independently (Allen & Johnston-Wilder, 2004), (Sutikno, 2007). The situation of such kind supports the occurrence of meaningful teaching and develops the values of positive character education for the students.

1.2 Character Education

One's character reflects one's positive and negative attitude, which is real and different from one another. A good character is badly needed in life nowadays, because it will guarantee the best life to someone and the surrounding community. It is a way to excellence and ethics. (Lickona & Davitson, 2005). It is a stable personal attitude as the result of a progressive and dynamic consolidation process, integrating words and action (Khan, 2010). It is one's natural characteristics in responding to something in a moral, quality way, realized in real actions through good behavior. It becomes the support and trigger, and makes one stand out from the others (Mulyasa, 2013), (furqon, 2010), (Akbar, 2015). A good character is related to knowing, loving, and doing good deeds (Sudrajat, 2011). Characteristic behavior is the manifestation of *Intelligence Quotient* (IQ), *Emotional Quotient* (EQ), and *Spiritual Quotient* (SQ), owned by someone (Marzuki, 2015). One's character is not automatically formed by itself; it has to be developed through sustainable education in the form of teaching and practice (Pala, 2011), (Zuchdi, Prasetya & Masruri, 2010).

Character education is a deliberate effort to promote virtues, to know what is good, to love what is good, and to do what is good, with behavior being the main core (Lickona, 1999), (Williams, 2000). Character education can be done by integrating character values in teaching processes in all subjects simultaneously with the Basic Competence to achieve (Sukestiyarno, Cahyono, & Pradnya, 2019), (Zuchdi, Prasetya & Masruri, 2010),(Dalimunte, 2015). Character education in school is done by integrating the intra-curricular activities and the unit of educational culture development in the teaching and learning processes in the classroom (Saidek & Islami, 2016). Besides, the strategy of character habituation can be applied through the application of a teaching model aiming at improving students' character (Retnawati, Apino & Anazifa, 2018). Teachers should have sufficient knowledge of character education values in order to be able to inculcate them so as to build the character of the students in school and community sustainably through a well-planned program (Rindrayani, 2020), (Salafudin, 2013), (Abdi, 2018), (Whitehead, 1952). The teachers, including mathematics teachers, who have knowledge of character and have a good character will find it easy to solve constraints in integrating character education in teaching processes.

1.3 Attitude and Mathematic Problem Solving Ability

Attitude is a tendency to consistently give positive or negative response to an object, and this tendency is resulted from learning; it is not inherent (Ajzen & Fishbein, 1970). Attitude is one of the learning outcome variables and it is the activeness of the students in mathematics teaching processes (Koyuncu & Dönmez, 2018) Mathematics teaching is very much affected by students' emotion (Hanin& Van Nieuwenhoven, 2016). Emotion, cognition, and aspiration are the scope of attitude (Myers, 1993). It is proved that there is a significantly positive relationship between attitude and mathematics learning achievement (Eskici, Ilgaz & Aricak, 2017), (Gunarti, 2017), (Hartati, 2015).

Council of Teachers of Mathematics (NCTM, 2000) states that problem solving ability is the standard of mathematics competence which the students must have. Problem solving is discovering hidden meaning which is finally understood (Polya, 1973). Polya adds that problem solving is an effort to discover the solution to a problem in order to achieve an objective which cannot be reached immediately. Other opinions say that problem solving is the life skill which involves a chain of processes, including interpreting, reasoning, analysing, predicting, evaluating, and contemplating (Anderson, 2009). Achievement and success in learning mathematics is related to mathematical belief, mathematical creativity through problem solving, social empowerment through mathematics, and wider appreciation of mathematics (Ernest, 2015). The concepts of problem solving, critical thinking, collaborative learning, independent learning, creativity, and so on are affected by attitude and cognition (Novak, 2010).

Efforts have to be made in order to know students' attitude toward mathematics and to change it to be positive in teaching with the aim of obtaining the expected behaviour because students' positive attitude toward mathematics affects their mathematics learning achievement (Eskici, Ilgaz & Aricak, 2017). Increasing the students' positive attitude toward mathematics will remove the obstacles for mathematics to enter their brain, to promote their long-term memory, and to develop better understanding outside memorization (Willis, 2010).

1.4 Model of Meaningful Teaching Integrating Character Education

The process of meaningful teaching integrating character education includes: (1) introducing values and habituation; (2) facilitating the acquisition of the awareness of the importance of values; (3) creating character-

oriented situation in school; and (4) internalizing positive values in students' daily habits through teaching of all subjects inside and outside the classroom (Kemendiknas, 2010).

Models of teaching which are meaningful and suitable for teaching mathematics include: *Advance Organizer* (OA), *Problem-Based Learning* (PBL), *Cooperative Learning* (CL), and *Contextual Teaching and Learning* (CTL). Those teaching models are adapted in the application of the Model of Meaningful Teaching Integrating Character Education (the MTICE Model). The MTICE Model is a conceptual framework used as the guide to plan, implement, and evaluate the meaningful teaching integrating character education. The syntax of the MTICE Model used in mathematics teaching processes in this research is shown in Figure 1.

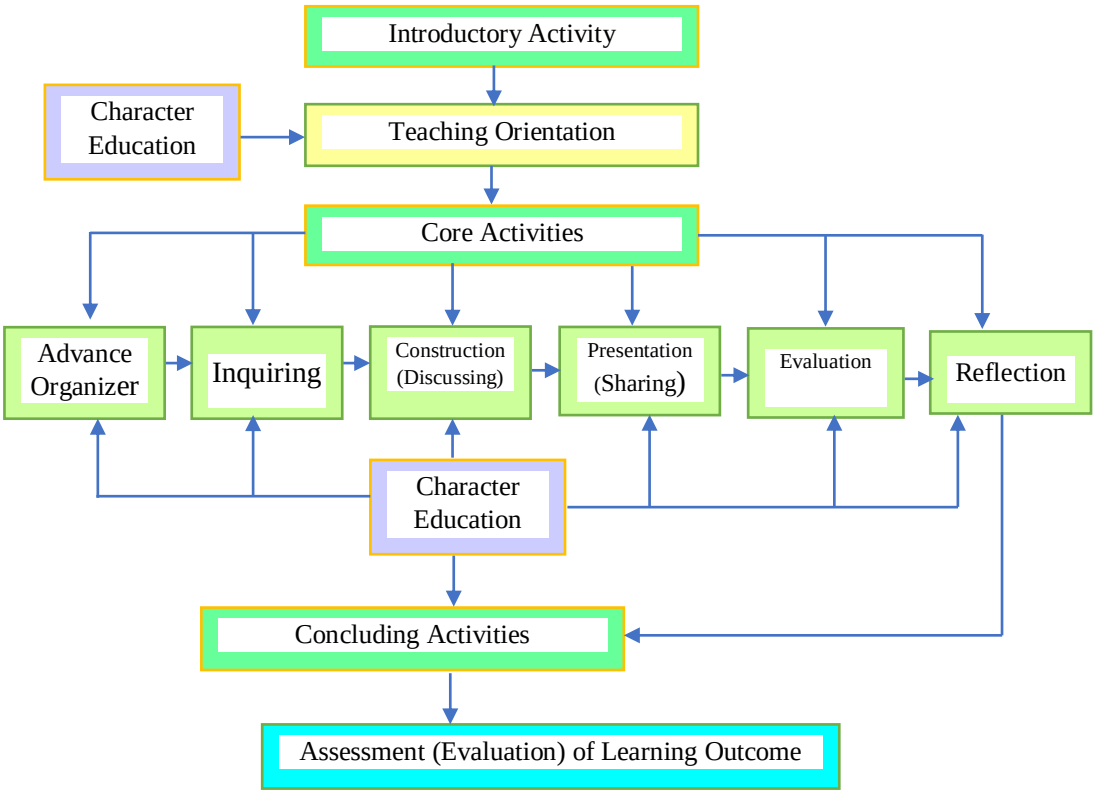

Figure 1. Flow Chart of Teaching in the Syntax of MTICE Model

The expected outcomes of the implementation of the MTICE Model in the mathematics subject in the classroom are: (1) feasibility of the process of meaningful teaching integrating character education; (2) the teachers doing the assessment of learning achievement in the aspects of knowledge, attitude, and skill in expressing mathematical ideas orally; (3) students' active involvement in teaching-learning processes; (4) students actualizing their attitude in accordance with the character values stated in the lesson plan during teaching-learning processes; (5) the improvement of students' attitude and problem solving ability.

The MTICE Model supports the implementation of Curriculum 2013 of Edited Version 2017 applied nowadays in Indonesia and its implication in the operational stage in front of the class. The supporting instrument of the implementation of the MTICE Model includes: lesson plans, student worksheet, and teaching result evaluation instrument. The teaching result evaluation instrument consists of student mathematics problem solving ability test, and student attitude questionnaire. The questionnaire is worked out by both the teachers and students.

2. Research Method

2.1 Research Design

This research applies the design of a quasi-experiment. The advantage of using the quasi-experiment is that it can measure the effectiveness of intervention and its application in mathematics teaching (Phoong et al, 2020). The research sample was established using the purposive sampling technique based on the ease, convenience, and interest of the teachers and students, and the ease of intervention. In this research, intervention was conducted in two state schools and in each school two out of eight classes designated by teachers were selected. Both schools have applied the same curriculum, i.e Curriculum 2013 (C-13) and have the same facilities. The independent variable is meaningful teaching integrating character education and the dependent variables are attitude/behaviour and mathematics learning achievement. The research was conducted from January to March 2020 in the academic year of 2019/2020. The research design is shown in Table 1 and Table 2.

Table 1. The Research Desain

Group	Pre-test	Intervention	Post-test
Experimental	Mathematics Learning Achievement Test (MLAT)	Meaningful teaching integrating character education (MTICE)	Mathematics Learning Achievement Test (MLAT)
Control	Mathematics Learning Achievement Test (MLAT)	Conventional Teaching (CT)	Mathematics Learning Achievement Test (MLAT)
Group	**Pre-non test**	**Intervention**	**Post-non tes**
Experimental	Attitude/Behaviour Evaluation Questionnaire (ABEQ)	Meaningful teaching integrating character education (MTICE)	Attitude/Behaviour Evaluation Questionnaire (ABEQ)
Control	Attitude/Behaviour Evaluation Questionnaire (ABEQ)	Conventional Teaching (CT)	Attitude/Behaviour Evaluation Questionnaire (ABEQ)

2.2 Research Sample

The sample of this research is grade VIII students of *madrasah tsanawiyah* (MTs), the school under the Ministry of Religious Affair of the Republic of Indonesia. The sample is 130 students aged 14 – 15 years old, consisting of 68 male and 62 female students of *madrasah tsanawiyahs* in Balikpapan and Samarinda, East Kalimantan Province, Indonesia. The sample is 130 students established randomly. It is divided into two groups: the experimental group consisting of 46 male and 19 female students and the control group consisting of 22 male and 43 female students. The experimental group was taught by using the model of meaningful teaching integrating character education (MTICE Model) while the control group was taught applying the conventional teaching model (CT Model). The social-economic background of the sample students is the same. All of them live in the urban areas and their family income is in the middle to above category. All of the sample students were taught by four mathematics teachers who have been teachers for more than 10 years and are holders of bachelor degree in mathematics education, which they got from teachers colleges in Indonesia. In order to avoid bias, two teachers were asked to apply the MTICE Model and to teach the experimental group. The other two teachers were asked to teach the control group applying the conventional teaching model in accordance with their own teaching styles.

2.3 Research Instrument

The research instrument consists of: (1) mathematics problem solving ability test (MPSAT) for assessing the students' mathematic problem solving ability; (2) attitude/behaviour evaluation questionnaire (ABEQ) for measuring the students' attitude/behaviour during teaching-learning processes; and (3) model response questionnaire (MRQ) for revealing the students' responses to the MTICE Model. The rubric in MPSAT is adapted from (Polya, 1973), i.e. understanding problems, making solution plan, solving problems based on plans, and concluding the result. The students' learning achievement improved by using the Polya's problem

solving method. (Hadi & Radiyatul, 2014). In details, the rubric of the evaluation result of MPSAT is presented in Table 3.

Table 2. Rubric of The Evaluation Result of MPSAT

Sub-skills	Score	Criteria
Understanding problems	2	The students write the information about the problem, i.e what is known and asked, correctly.
	1	The students write information from question, i.e what is known and asked, but not related to the problem, correctly.
	0	The students do not write any information.
Making solution plans	2	The students write the information on the requirements (formula) for problem solution and use the information.
	1	The students write the plan for problem solution incoherently.
	0	The students do not write the plan for problem solution.
Solving problems according to solution plans	3	The students solve the problem according to the plan, without mistakes in procedure and calculation.
	2	The students solve the problem according to the plan, without mistakes in procedure, but with mistakes in calculation.
	1	The students solve the problem according to the plan, but with mistakes in procedure and calculation.
	0	The students do not solve the problem according to the plan.
Drawing conclusion	2	The students write conclusion according to the question and the result obtained.
	1	The students draw conclusion not in accordance with the question and the result obtained.
	0	The students do not write any conclusion

The display and content of MLAT were validated by three mathematics education experts and two MTs mathematics teachers. The validation was related to: (1) the conformity of the indicators with the questions, (2) the difficulty level of the questions, (3) the language and writing style, and (4) the correctness of the concepts. The analysis of the result of the validation used Aiken index coefficient value. The researchers developed 12 test items eight of which were valid and could be used, with Aiken index coefficient value of V =1.0 ($0.8 \leq V$) or in a very valid category (Retnawati, 2016). Meanwhile, the result of the analysis of the instrument reliability showed the value of Alpha Cronbach α =1.0 (nilai $\alpha > 0.94$) which showed that it was reliable (Phoong et al, 2020).. The Attitude/Behaviour Evaluation Questionnaire (ABEQ) consists of character education values actualized by the students in teaching-learning processes with the indicators as shown in Table 2.

Table 3. Character Education Values and Indicators for Measuring Students' Attitude/Behaviour

Character Education Values	Indicators
Patience	Doing work not in a hurry.
	Not easily getting angry.
Politeness	Speaking in pleasant language.
	Respecting friends and teachers.
Honesty	Admitting own weaknesses and others' strengths.
	Not giving nor receiving answers during the test.
Discipline	Obeying the rules.
	Submitting assignments quickly.
	Coming to class punctually.
	Asking permit to enter or go out of the classroom.
Perseverance	Not feeling hopeless before achieving a goal.
Self-confidence	Being confident with own ability.
Curiosity	Diligently asking questions and reading references.
Activeness	Participating in discussions and group work.
	Participating in assignment completion.
Carefulness	Writing information according to needs for problem solution.
	Answering questions correctly procedurally.
	Not making mistakes in calculation.

Bravery	Being brave in asking questions and expressing ideas.
Critical Thinking	Not easily accepting and refusing friends' ideas before checking.
	Summarizing learning result correctly.
Creativeness	Doing assignment in more than one way.
Collaboration	Collaborating with friends in doing assignments.
Commitment	Doing and accepting group decisions.
Responsibility	Studying fully consciously and seriously.
	Taking the consequences of what have been done.
	Apologizing for the mistakes made.
	Doing individual and group work.

The display and content of ABEQ and MRQ were validated by one mathematics education expert, one character education expert, one mathematics education evaluation expert, and two MTs mathematics teachers. The validation was related to (1) the conformity of character education values with the indicators, and (2) the language and writing style. The researchers developed 17 statements of ABEQ and eight statements of ARM, and the validation result showed that all of the statements were valid and could be used, with Aiken index coefficient value of V =1.0 or in a very valid category (Retnawati, 2016). Meanwhile, the result of the analysis of the instrument reliability showed the value of Alpha Cronbach α =0.9 ($\alpha > 0.94$) which showed that it was reliable (Phoong et al, 2020)..

2.4 Experiment Procedure

Before conducting the experiment, the researchers developed the MTICE Model and its device, including the lesson plans, student worksheet, and evaluation instrument. Then they asked four experts in teaching media, mathematics teaching, character education, and educational evaluation, as well as two senior mathematics teachers for feedbacks. Upon receiving the feedbacks from the four experts and two teachers, they tried out the developed model in order to get an appropriate model and device. After they got the formal permit from the Branch Office of Ministry of Religious Affair in Balikpapan and Samarinda, and all madrasah principals and teachers, they delivered consent forms to students so that they could participate voluntarily and could withdraw any time. The pre-test and pre-nontest were administered after the students signed the consent form. Afterward, the experimental and control groups participated in teaching-learning activities four times, each taking them 120 minutes (4 x 120 minutes = 480 minutes).

The teachers teaching the experimental group applied the MTICE Model, playing roles as facilitators, and the students actively involved in the teaching-learning processes. The teaching steps are as follows.

First, **Introductory Activity: Teaching Orientation.** The teaching began with teaching orientation in which the teacher's activities include: a) greeting the students and leading a prayer together; b) conducting character education by facilitating the students to assemble in accordance with their own group showing the character of patience (being not in a hurry), politeness, rule obedience, and commitment to group decision; c) giving a short explanation of the teaching model to be applied, whose core point was that the students: constructed knowledge independently to discover the truth in "Pythagoras Theorem" using the prepared student worksheet in groups, related the existing knowledge with the new materials they were to learn in solving problems in groups; d) directing the students to arrange the seats according to the previously decided groups; e) calling the roll; f) giving information related to the integration character education values in the teaching-learning processes; g) informing the topic of the teaching materials, i.e. Pythagoras Theorem; h) informing the teaching objectives, including three aspects of knowledge, attitude/behaviour, and psychomotor competence.

***Secondly*, Core Activity: (1) Advance Organizer.** The activities include: a) character education by facilitating the students to listen well, politely, carefully, and patiently; b) explaining "Pythagoras Theorem" concept mapping (see Figure 2) previously prepared; c) strengthening the students' prerequisite knowledge for relating the knowledge of "Pythagoras Theorem" with previously-learned mathematic concept interactively; d) arousing the students' curiosity. There is a significant interaction between the students' initial knowledge of mathematics and mathematics representation and problem solving abilities (Effendi, 2012). **(2) Questioning.** The activities include: a) character education done by facilitating the students to show the characters of patience, politeness, carefulness, activeness, critical thinking, creativeness, collaboration, responsibility, bravery, commitment to group decision; b) asking the students to write questions and to ask questions by firstly raising their finger.

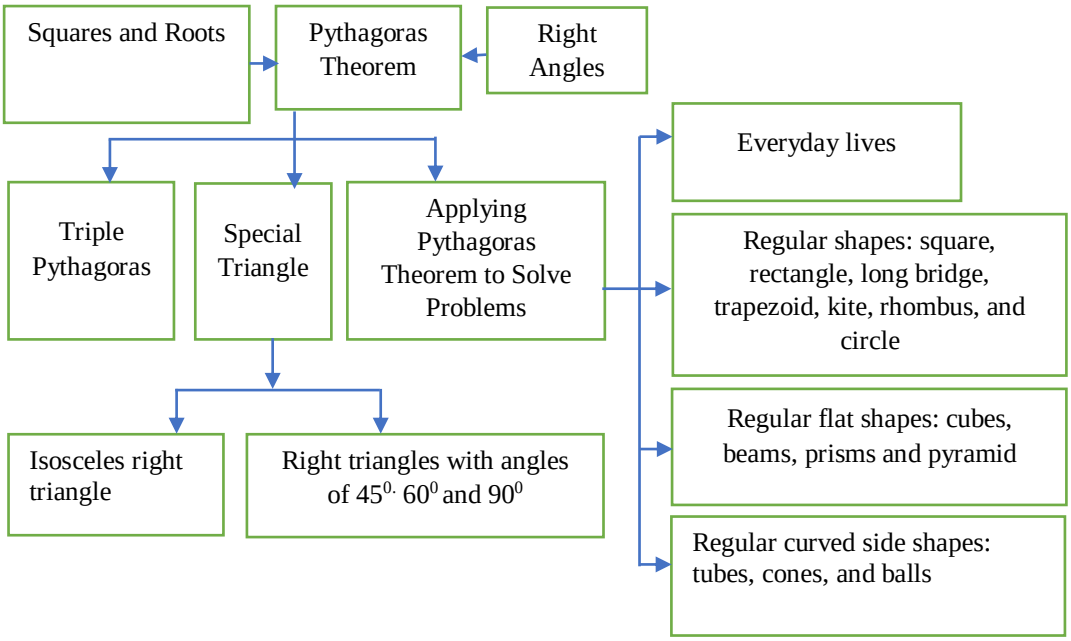

Figure 2. Pythagoras Theorem Concept Map

(3) Constructing. The activities include: a) character education done byfacilitating the students to actively work out the student worksheet showing the characters of patience, politeness, collaboration, commitment to group decision, carefulness, creativeness, critical thinking, discipline, and responsibility; b) delivering student worksheet; c) the students discussing in groups to find the truth of "Pythagoras Theorem" by paying a close attention to pictures in the worksheet; d) the teacher guiding the students in group discussion. (4) Presentasi. The activities include: a) character education done by facilitating the students to show the characters of collaboration, negotiation, discipline, speaking politely, confidence in expressing opinions, commitment to group decision, justice, and responsibility; b) asking the students to make presentation in front of the class. **(4) Evaluation.** The activities include: a) character education done by facilitating the students to show the characters of patience, politeness, honesty, collaboration, negotiation, carefulness, creativeness, critical thinking, discipline, justice, and responsibility; b) asking the students to apply their understanding of "Pythagoras Theorem" concept by working out the student worksheet in groups. **(5) Reflection.** The activities include: a) briefly reviewing what happened during the teaching-learning process; b) stating the concept and answers and summarizing learning result; c) character education done by asking the students to listen to and record the summary of the learning result carefully and patiently.

***Thirdly*. Concluding Activities** include: a) suggesting the students to always show character education values integrated in their learning process in their life; b) informing the topic of the materials in the next meeting; c) asking the students to pray together and saying goodbye.

The teacher teaching the experimental group applied the conventional teaching model and dominated the teaching process so that the students became passive listeners. The teaching steps are as follows: (1) the teacher led the prayer, called the roll, gave apperception, informed the teaching objectives; (2) the teacher explained the materials, discussed examples of problems, asked the students to take notes; (3) the teacher asked the students to ask questions; (4) the teacher asked the students to answer questions individually; (5) the teacher asked the students' representative to write answers to questions on the board and asked the other students to make correction; (7) the teacher delivered the summary of the discussion about "Pyhagoras Theorem" and asked the students to take notes and studied them at home; (8) the teacher informed the materials for the following meeting; (9) the teacher led the prayer.

2.5 Data Analysis

The normality and homogeneity testing was conducted to meet the requirement of parametric statistic testing. The analysis was conducted with the help of SPSS version 25. The normality testing used Kolmogorov Smirnov and Shapiro-Wilks (Hair et al, 1995). The result of the analysis shows normal distribution because the value of *Sig* is > 0.05 (See Table 3)

Table 4. Result of Kolmogorov-Smirnov and Shapiro-Wilk Test

Groups			Kolmogorov-Smirnov			Shapiro-Wilk		
			Stati-stik	*df*	Sig	Stati-stik	*df*	Sig
Problem Solving Ability	Experimental	Pre-test	0.057	65	0.200	0.988	65	0.791
		Post-test	0.072	65	0.200	0.977	65	0.270
	Control	Pre-test	0.069	65	0.200	0.979	65	0.318
		Post-Test	0.081	65	0.200	0.969	65	0.102
Attitude	Experimental	Pre-non test	0.072	65	0.200	0.966	65	0.137
		Post-non test	0.077	65	0.200	0.974	65	0.183
	Control	Pre-test	0.098	65	0.199	0.973	65	0.165
		Post-non test	0.671	65	0.200	0.981	65	0.418

Note *Sig > 0.05

Furthermore, the analysis used Levene's Test of Equality of Error Variance (Hair et al, 1995). to see the homogeneity of the data variants. The result of the analysis (see Table 4) shows that the data variants are homogeneous. Therefore, the assumption is accepted.

Table 4. Result of *Levene's Test of Equality of Error Variance*

Independent Variable	F	df1	df2	Sig
Problem Solving Ability	0.664	1	128	0.424
Attitude	0.751	1	128	0.438

Note *Sig > 0.05

Now that the assumption was accepted, the analysis was continued to investigate the effect of the MTICE Model on the students' attitude and problem solving ability. The data analysis used the One-way ANOVA with the help of SPSS version 25 at the significance level of 0.05.

3. Research Findings

The result of the analysis using the One-way ANOVA to reveal the difference in the average score of the pre-test between the experimental group and the control group in terms of mathematics problem solving ability and attitude can be seen in Table 9.

Table 5. Result of One-way ANOVA Pre-Test and Pre-NonTest Average Scores

Independent Variable	Group	M	SD	df	F	Sig
Problem Solving Ability	Experimental	30,32	9.059	1	1.064	0.304
	Control	31.95	8.962			
Attitude	Experimental	50,97	4.070	1	2.442	0.121
	Control	51,50	3.666			

Note: *Sig < 0.05

Table 5 shows that there is no significant difference between the experimental group and the control group in the pre-test scores of mathematic problem solving ability (F = 1.064; Sig > 0.05) and the pre-non test scores of attitude (F = 2.442, Sig > 0.05). This means that both groups have the same initial ability.

Furthermore, the researchers explored the main effect of the univariate independent variable on the dependent variable using the One-way ANOVA to answer the research question. The result is shown in Table 10.

Table 6. Result of One-way ANOVA Post-Test and Post-Non Test Average Scores

Independent Variables	Groups	M	SD	df	F	Sig
Problem Solving Ability	Experimental	71,34	12,147	1	118.101	0.000
	Control	49,06	11,207	1		
Attitude	Experimental	68.45	4.327	1	186.341	0.000
	Control	58.69	3.803	1		

Note: *Sig < 0.05

Table 6 shows that the post-test average score of mathematic problem solving ability of the experimental group (M = 71,34; SD = 12,147) is significantly higher that of the control group (M = 49,06; SD = 11,207). The post-test average score of attitude of the experimental group (M = 68.45; SD = 4.327) is significantly higher

than that of the control group (M = 58.69; SD = 3.803). In short, there is a significant difference in the score of mathematic problem solving ability [F (1.130) = 118.101; Sig < 0.05] and attitude [F (1.130) = 186.341; Sig < 0.05] between the two groups. This finding indicates that the different treatments affect the pos-test and post-non test average scores of the experimental group and the control group.

4. Discussion

This research aims to investigate the effectiveness of the MTICE Model in improving students' mathematic problem solving ability and attitude compared to the conventional teaching model. The result of the One-way ANOVA test shows that the students taught by using the MTICE Model have higher post-test and post-non test scores than those taught by using the conventional teaching model. This shows that the MTICE Model is effective in improving the mathematic problem solving ability and attitude of the students.

The activities of the teaching using the MTICE Model could improve the problem solving ability and attitude of the students, because the implementation of the MTICE Model required the active involvement of the students in the teaching-learning processes. They had to collaborate, discuss in groups, ask questions, make presentation, and be responsible to construct knowledge and solve problems individually using student worksheet. There was a lot of fun in learning because it involved emotion, feeling, and responsibility. The teacher did not dominate the activity, but first of all the teacher had to assure that the students' previous knowledge was connected to the new materials through the activity of *advance organizer*.

Furthermore, the teacher functioned only as the facilitator, guide, director when there was a group having difficulties, and facilitator of character education. In the long run, this condition will result in meaningful teaching occurring to the students, where they are motivated to construct knowledge independently, create, think critically, persevere, and help each other. Besides, the students explored positive attitude during the teaching-learning processes so that they criticized each other bringing about the formation of the characters of carefulness, honesty, discipline, patience, perseverance, and commitment to accomplishing assignments. This might be due to the fact that in teaching applying the MTICE Model in each session the teacher always asked the students to actualize the character values stated in the lesson plan whenever they worked in groups.

The above finding is in line with the findings of other studies which concluded that meaningful teaching had effects on problem solving concepts, critical thinking, collaborative learning, independent learning, and creativity; it improved affective experience which became the basis for the integration of the construction of thought, feeling, and action leading to the empowerment of commitment and responsibility; and it can become the foundation of creative thinking (Novak, 2010), (Novak, 2011), (Novak, 2013). In addition, the teaching based on problem solving is very suitable to apply in mathematics teaching, because it can make students solve contextual problems so that it arouses their understanding (Kaharuddin, 2018). Improvement in cognitive, psychomotor, and affective domains can happen through meaningful teaching because in its implementation, meaningful teaching integrates learning achievement in cognitive, psychomotor, and affective domains (Jonassen & Strobel, 2006), 5].

Furthermore, in each activity, the teacher always asked the students to actualize the character values stated in the lesson plan when they worked in groups. This finding is consistent with the findings of previous studies that character education integrated in mathematics teaching was quite effective in improving mathematics learning achievement and in inculcating character values in the students (Salafudin, 2013), (Hudha, Ekowati & Husamah, 2014), (Susanti, Sukestiyarno & Sugiharti, 2012), (Falkenberg, & Noyes, 2010). This is even strengthened by the statement that the knowledge obtained directly through experience significantly affects attitude/behaviour [28].

In short, the higher post-test and post-non test scores of the students in the experimental class may result from the application of the MTICE Model which facilitates the students to learn mathematical concepts by constructing mathematic knowledge individually in groups, solving problems contextually, involving actively, and experiencing the transfer of knowledge, attitude, and skill with the teacher respecting students' characteristics (Marsigit, 2016), (Lestari, 2015). The students' problem solving ability develops well when the teacher relates teaching with their real lives (Wright, 2001), (Irwanto et al, 2019) The teacher is no longer the highest authority of knowledge and neither is he or she an indoctrinator; he or she is a facilitator who guides the students to construct knowledge independently (Gazali, 2016). In addition, the students' experience with meaningful teaching is the facility to achieve the highest learning achievement (Sutikno, 2007).

Furthermore, the application of the MTICE Model gives opportunities to students to create, collaborate, and interact, making it possible for the development of their positive character in the teaching of mathematics. The achievement and success in the teaching of mathematics is related to mathematical belief, mathematical creativity through problem solving, social empowerment through mathematics, and wider appreciation of mathematics (Ernest, 2015). The positive attitude toward mathematics affects mathematics learning achievement (Eskici, Ilgaz & Aricak, 2017), puts aside barriers hindering mathematics into their brains, promotes long-term

memory, and develops better understanding outside memorization (Willis, 2010). One's character is not inherent; it has to be developed through sustainable teaching and practice (Pala, 2011), (Zuchdi, Prasetya & Masruri, 2010)..

5. Conclusion and Suggestion

As a conclusion, the average score in the post-test of mathematic problem solving ability and the average score in post-non test of attitude of the students who were taught by applying the MTICE Model are significantly higher than the average score in the post-test and post-non test of the students who were taught by applying the conventional teaching model. The findings of this research support those of the previous research in relation to the effectiveness of meaningful teaching which integrates character education in mathematics teaching. This research proves that meaningful teaching integrating character education is effective in improving the mathematics learning achievement of the students of MTs in terms of their problem solving ability and attitude. In order to improve the students' mathematic problem solving ability and attitude, mathematics teachers need to consider this finding and use it in mathematics teaching in order to support the implementation of Curriculum 2013, and achieve the goal of Indonesian national education. Therefore, it is suggested that mathematics teachers should frequently use the MTICE Model as an effort to improve the students' mathematic problem solving ability and attitude.

6. Limitation and Recommendation

Although the MTICE Model is effective in improving students' mathematics learning achievement, there are some shortcomings of the model. First, the materials taught is limited to the materials of Pythagoras Theorem. Second, the teaching was conducted in four sessions, and for this reason, a long-term study is needed. This research investigated students' mathematic problem solving ability and attitude; further study is needed to investigate the effects of the MTICE Model on other variables including motivation, interest, and mathematic communication. Besides, it is also necessary to investigate the effects of the MTICE Model on the ability to solve problems in natural science subjects including physics, biology, chemistry, and other subjects.

Reference

Republik Indonesia (2003). Undang-undang Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional.

Rukiyati, R. (2013). Urgensi Pendidikan Karakter Holistik Komprehensif Di Indonesia. *Jurnal Pendidikan Karakter*, (2), 120651.

Zurqoni, Z., Retnawati, H., Arlinwibowo, J., & Apino, E. (2018). Strategy and implementation of character education in senior high schools and vocational high schools. *Journal of Social Studies Education Research, 9*(3), 370-397.

Jonassen, D. H., & Strobel, J. (2006). Modeling for meaningful learning. In *Engaged learning with emerging technologies* (pp. 1-27). Springer, Dordrecht.

Hossain, A., & Tarmizi, R. A. (2013). Effects of cooperative learning on students' achievement and attitudes in secondary mathematics. *Procedia-Social and Behavioral Sciences*, *93*, 473-477.

Bostic, J. D., Pape, S. J., & Jacobbe, T. (2016). Encouraging sixth-grade students' problem-solving performance by teaching through problem solving. Investigations in Mathematics Learning, 8(3), 30–58.

Santos-Trigo, M., & Reyes-Martinez, I. (2019). High school prospective teachers' problem-solving reasoning that involves the coordinated use of digital technologies. International Journal of Mathematical Education in Science and Technology, 50(2), 182-201.

Ahdhianto, E., Marsigit, Haryanto, & Santi, N. N. (2020). The effect of metacognitive-based contextual learning model on fifth-grade students' problem-solving and mathematical communication skills. *European Journal of Educational Research*, 9(2), 753-764. https://doi.org/10.12973/eu-jer.9.2.753

Effendi, L. A. (2012). Pembelajaran matematika dengan metode penemuan terbimbing untuk meningkatkan kemampuan representasi dan pemecahan masalah matematis siswa SMP. *Jurnal Penelitian Pendidikan*, *13*(2), 1-10.

Pala, A. (2011). The need for character education. *International Journal of Social Sciences and Humanity Studies*, *3*(2), 23-32.

Kosim, M. (2012). Urgensi pendidikan karakter. *KARSA: Journal of Social and Islamic Culture*, *19*(1), 84-92.

Sahroni, D. (2017). Pentingnya pendidikan karakter dalam pembelajaran. In *Prosiding Seminar Bimbingan Dan Konseling*, 1(1), 115-124. *Pendidikan*, *9*(3).

Lickona, T., & Davitson, M. (2005). *Smart & good high schools: Integrating excellence and ethics for success in school, bork, and Beyond*. Center for the 4th and 5th Rs (Respect and Responsibility). Washington, D.C. Character Education Partnership: State University of New York College at Cortland

Islam, S. (2017). Karakteristik pendidikan karakter; menjawab tantangan multidimensional melalui implementasi Kurikulum 2013. *Edureligia; Jurnal Pendidikan Agama Islam*, *1*(1), 89-100.

Alfarisy, F., & Baptist, K. J. (2017, November). The Importance of Character Education: Comparison of the Implementation of Character Education in Uganda and Indonesia. In *International Conference on Education* (Vol. 1, No. 1).

Salafudin. (2013). Pendidikan karakter melalui pendidikan matematika. *Jurnal Penelitian*, *10*(1), 63-76.

Republik Indonesia. (2017). Peraturan Presiden Nomor 87 Tahun 2017 tentang Penguatan Pendidikan Karakter (PPK).

Tim Pusat Penilaian Pendidikan. (2019). Model Penilaian Pendidikan Karakter. Jakarta, Pusat Penilaian Pendidikan.

Suyitno, H. (2019). Integration of Character Values in Teaching-Learning Process of Mathematics at Elementary School of Japan. *International Journal of Instruction*, *12*(3), 781-794.

Nursanti, B. Y., Rochsantiningsih, D., Joyoatmojo. S., & Budiyono. (2016). Mathematics education model in Indonesia through inquiry-based realistic mathematics education approach to improve character. *International Journal of Education and Research*, 4(9).323-332. http://www.ijern.com/journal/2016/September-2016/28.pdf

Furqon, H. (2010). *Pendidikan karakter: Membangun peradaban bangsa*. Surakarta: Yuma Pustaka.

Fardian, R. F. (2011). *Implementasi pendidikan berkarakter di SMA negeri 3 semarang* (Doctoral dissertation, Universitas Negeri Semarang).

Marzuki. (2015). Pengintegrasian pendidikan karakter dalam pembelajaran di sekolah. *Jurnal Pendidikan Karakter*, 2(1), 33-44.

Irfan, M. (2017, May). Role of Learning mathematics in the character building. In *Proceedings International Conference on Education* (pp. 599-604).

Hudha, A. M., Ekowati, D. W., & Husamah, H. (2014). Character Education Model in Mathematics And Natural Scinces Learning At Muhammadiyah Junior High School. *International Journal of Education, Learning & Development*, *2*(4), 33-47.

Susanti, E. L., Sukestiyarno, Y. L., & Sugiharti, E. (2012). Efektivitas Pembelajaran Matematika Dengan Metode Problem Posing Berbasis Pendidikan Karakter. *Unnes Journal of Mathematics Education*, *1*(1).

Falkenberg, T., & Noyes, A. (2010). Conditions for linking school mathematics and moral education: A case study. *Teaching and Teacher Education*, *26*(4), 949-956.

Dewey, J. (2001). *Democracy and education*: *A penn state electronic classics series publication*. Pennsylvania*:* The Pennsylvania State University.

Ivie, S. D. (1998). Ausubel's learning theory: An approach to teaching higher order thinking skills. *The High School Journal*, *82*(1), 35-42. http://www.jstor.org/stable/40364708

Novak, J. D. (2010). *Learning, creating, and using knowledge: Concept maps as facilitative tools in schools and corporations*. Routledge.

Novak, J. D. (2011). A theory of education: Meaningful learning underlies the constructive integration of thinking, feeling, and acting leading to empowerment for commitment and responsibility. *Meaningful Learning Review*, *1*(2), 1-14.

Novak, J. D. (2013). *Meaningful learning is the foundation for creativity*. Universidad de La Laguna: Servicio de Publicaciones.

Kaharuddin, A. (2018). Effect of Problem Based Learning Model on Mathematical Learning Outcomes of 6th Grade Students of Elementary School Accredited B in Kendari City. *International Journal of Trends in Mathematics Education Research*, 1(2), 43-46. doi:10.33122/ijtmer. V 1i2.14

Willis, J. (2010). *Learning to love math: teaching strategies that change student attitudes and get results*. Alexandria, Virginia. ASCD.

Allen, B., & Johnston-Wilder, S. (Eds.). (2004). *Mathematics education: Exploring the culture of learning*. Psychology Press.

McLaughlin, M. W., & Talbert, J. E. (2006). *Building school-based teacher learning communities: Professional strategies to improve student achievement* (Vol. 45). Teachers College Press.

Lestari, I. (2015). Pengaruh waktu belajar dan minat belajar terhadap hasil belajar matematika. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *3*(2).

Gazali, R. Y. (2016). Pembelajaran matematika yang bermakna. *Math Didactic: Jurnal Pendidikan Matematika*, *2*(3), 181-190.

Silva, C. C. D., Oliveira, A. K. S. D., Egry, E. Y., Neto, L., de Andrade, E., Anjos, U. U. D., & Silva, A. T. M. C. D. (2013). Constructing a Gowin's V diagram to analyze academic work in Nursing. *Revista da Escola de Enfermagem da USP*, *47*(3), 709-713.

Ausubel, D. P. (1961). In defense of verbal learning. *Educational Theory*, *11*(1), 15-25.

Kinchin, I., & Hay, D. (2005). Using concept maps to optimize the composition of collaborative student groups: a pilot study. *Journal of Advanced Nursing*, *51*(2), 182-187.

Degeng, N. S. (2013). Ilmu pembelajaran: Klasifikasi variabel untuk pengembangan teori dan penelitian. *Bandung: Aras Media*.

Zurita, G., Hasbun, B., Baloian, N., & Jerez, O. (2015). A blended learning environment for enhancing meaningful learning using 21st century skills. In *Emerging Issues in Smart Learning* (pp. 1-8). Springer, Berlin, Heidelberg.

Sailin, S. N., & Mahmor, A. N. (2018). Improving student teachers' digital pedagogy hrough meaningful learning activities. Malaysian Journal of Learning and Instruction, 15(2), 143–173.

Marsigit, M. (2016). Pembelajaran matematika dalam perspektif kekinian. *Math Didactic: Jurnal Pendidikan Matematika*, *2*(3), 132-141.

Mensah, J. K., Okyere, M., & Kuranchie, A. (2013). Student attitude towards mathematics and performance: Does the teacher attitude matter. *Journal of Education and Practice*, *4*(3), 132-139.

Sutikno, M. S. (2007). Menggagas Pembelajaran Efektif dan Bermakna. *Cetakan kedua. Mataram. NTP Press. Kinerja*.

Khan, Y. (2010). *Pendidikan karakter berbasis potensi diri*. Yogyakarta*:* Pelangi Publishing.

Mulyasa, E. (2013). *Pengembangan dan implementasi kurikulum 2013: kerubahan dan pengembangan kurikulum 2013 merupakan persoalan penting dan genting*. Jakarta: Bumi Akasara.

Akbar, E. (2015). Pendidikan islami dalam nilai-nilai kearifan lokal didong. *Al-Tahrir: Jurnal Pemikiran Islam*, *15*(1), 43-65.

Sudrajat, A. (2011). Mengapa Pendidikan Karakter.? *Jurnal Pendidikan Karakter*, *1*(1).

Zuchdi, D., Prasetya, K. Z., & Masruri, S. M. (2010). Pengembangan model pendidikan karakter terintegrasi dalam pembelajaran bidang studi di Sekolah Dasar. *Jurnal Cakrawala Pendidikan*, *1*(3).

Lickona, T. (1999). Character education: Seven crucial issues. *Action in Teacher Education*, *20*(4), 77-84.

Williams, M. M. (2000). Models of character education: Perspectives and developmental issues. *The Journal of Humanistic Counseling*, *39*(1), 32-40.

Sukestiyarno, Y. L., Cahyono, A. N., & Pradnya, I. N. (2019, October). Integrating character education in mathematics learning in Indonesia and Denmark. In *Journal of Physics: Conference Series* (Vol. 1321, No. 3, p. 032014). IOP Publishing.

Dalimunte, A. A. R. (2015). Strategi dan implementasi pelaksanaan pendidikan karakter di SMP N 9 yogyakarta. *Jurnal Pendidikan Karakter, Tahun V, Nomor 1, April 2015*, 102-111.

Saidek, A. R., & Islami, R. (2016). Character Issues: Reality Character Problems and Solutions through Education in Indonesia. *Journal of Education and Practice*, *7*(17), 158-165.

Retnawati, H., Apino, E., & Anazifa, R. D. (2018). Impact of character education implementation: A goal-free evaluation. *Problems of Education in the 21st Century*, *76*(6), *881-899*.

Rindrayani, S, R (2020). The implementation of character education in indonesia high school curriculum program. *Universal Journal of Educational Research* 8(1): 304-312, 2020.

Abdi, M. I. (2018). The Implementation of Character Education in Kalimantan, Indonesia: Multi Site Studies. *Dinamika Ilmu*, *18*(2), 305-321.

Whitehead, A. N. (1952). *The aim of education and others essays*. USA: New American Library

Ajzen, I., & Fishbein, M. (1970). The prediction of behavior from attitudinal and normative variables. *Journal of experimental social Psychology*, *6*(4), 466-487.

Koyuncu, B., & Dönmez, P. (2018). Predictive Value of Sense of Self-Efficacy and Attitudes of High School Students for Their Resistance to Mathematics. *Universal Journal of Educational Research*, *6*(8), 1629-1636.

Hanin, V., & Van Nieuwenhoven, C. (2016). The influence of motivational and emotional factors in mathematical learning in secondary education. *European Review of Applied Psychology*, *66*(3), 127-138.

Myers, D. G. (1993). Social Psychology (4th ed.). New York: McGraw-Hill.

Eskici, M., Ilgaz, G., & Aricak, O. T. (2017). Development of Mathematics Course Attitude Scale: A Preliminary Study of Validity & Reliability. *Universal Journal of Educational Research*, *5*(n12A), 63-70.

Gunarti, E. (2017). Hubungan Antara Kreativitas, Kemampuan Numerik dan Sikap Siswa terhadap Pelajaran Matematika dengan Prestasi Belajar Matematika Siswa Kelas VIII SMP Negeri se-Kecamatan Pundong. *UNION: Jurnal Ilmiah Pendidikan Matematika*, *5*(1), 1-10.

Hartati, L. (2015). Pengaruh gaya belajar dan sikap siswa pada pelajaran matematika terhadap hasil belajar matematika. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *3*(3).

NCTM). (2000). *Principles and standards for school mathematics* (Vol. 1). National Council of Teachers of Mathematics

Polya. (1973). How to Solve it, Second Edition. Princeton. New Jersey Princeton University Press.

Anderson, J. (2009). Mathematics curriculum development and the role of problem solving. In K. School (Ed.), Proceedings of 2009 Australian Curriculum Studies Association National Biennial Conference. Curriculum: A National Conversation (pp. 1-8). Australian Curriculum Studies Association.

Ernest, P. (2015). The social outcomes of learning mathematics: Standard, unintended or visionary? *International Journal of Education in Mathematics, Science and Technology*, *3*(3), 187-192.

Kemendiknas. (2010). *Rencana induk pengembangan pendidikan karakter bangsa.* Kementrian Pendidikan Nasional Badan Penelitian dan Pengembangan Pusat Kurikulum.

Phoong, S. Y., Phoong, S. W., & Phoong, K. H. (2020). The Effectiveness of Frog Virtual Learning Environment in Teaching and Learning Mathematics. *Universal Journal of Educational Research*, *8*(3B), 16-23.

Hadi, S., & Radiyatul, R. (2014). Metode pemecahan masalah menurut polya untuk mengembangkan kemampuan siswa dalam pemecahan masalah matematis di sekolah menengah pertama. *EDU-MAT: Jurnal Pendidikan Matematika*, *2*(1).

Retnawati, H. (2016). Validitas Reliabilitas dan Karakteristik Butir. *Yogyakarta: Parama publising.*

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). Multivariate data analysis. Prentice-Hall.

Wright, P. (2001). School-based issues and appropriate technology. In R. C. Wicklein (Ed.), Appropriate technology for sustainable living: ITEA 50th yearbook (pp. 133– 152). *International Technology Education Association.*

Irwanto, Saputro, A. D., Rohaeti, E., & Prodjosantoso, A. K. (2019). Using inquiry-based laboratory instruction to improve critical thinking and scientific process skills among preservice elementary teachers. *Eurasian Journal of Educational Research*, 80, 151-170. https://doi.org/10.14689/ejer.2019.80.8