

## ISBN: 978-602-60343-2-8

AISTSSE Annual International Seminar on Trends Science and Science Education

# Proceedings

The 3rd AISTSSE Trends in Science and Science Education

7 October 2016

Organized by: Faculty of Mathematics and Natural Sciences Medan State University North Sumatera-Indonesia

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Publisher: Research Institute of Medan State University (Lembaga PenelitianUNIVERSITAS NEGERI MEDAN) Jln. Willem Iskandar, Psr V Medan 20222; Telp (061) 6636757; Fax. (061) 6613319-6614002 – Medan, Indonesia

Proceedings



The 3rd AISTSSE (Trends in Science and Science Education) 7 October 2016Organized by: Faculty of Mathematics and Natural Sciences Medan State University - North Sumatera-Indonesia : Research Institute Medan State University Publisher (Penerbit Lembaga Penelitian Universitas Negeri Medan)

V, 251 pages, 27 cm

ISBN: 978-602-60343-2-8

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### Preface I

Welcome to the 3rd Annual International Seminar on Trends in Science and Science Education 2016. This is the third time we are hosting this seminar and we are proud to inform you that this seminar is an annual event in our calendar and will be held every year since 2014. We are inviting international recognized speakers from several countries to share their latest discoveries to all of us in Biology, Chemistry, Physics, Mathematics and Science Education fields. Well known researchers in science and science education will share their experiences and knowledge so we can have up to date the information. This is one of the goals of this seminar.

As science researcher we realize the importance of information exchange among us. The new information enlighten our mind and give us ideas on what to do next in our research and how to do it. This new informationoften become the basic for our next project in particular, and become the upcoming year research trends in general. Information exchange also keeps us updated, allow us to give and receive suggestions and critics which will lead us to better results. Thus, we need a forum where we can share and exchange information. Seminar, conference and other scientific gathering are media for us to do so.

Wewould like to thanksto all the researchers who responded to our call for papers and participant of this seminar. Let us share information about our latest discoveries in science and science education and set the trends for the upcoming year. Let us collaborate and create new opportunities for a better and more holistic research.

Finally, we convey our thanks to the Rector of State University of Medan, Prof. Dr. SyawalGultom, M.Pd and all the vice rector for the support and attention to this seminar and also to all of the committee members for their work in ensuring the run of this seminar. Once again, welcometo the 3rd Annual International Seminar on Trends in Science and Science Education 2016.

Medan, 7 October 2016

Dr. Asrin Lubis, M.Pd. DeanFaculty of Mathematics and Natural Sciences State University of Medan



### Preface II

First, let us be thankful to the one and all-powerful God that on this fine morning we are still given bodily and spiritual health and can gather together in this room, on our beloved capital city of North Sumatra, Medan.

A warm and special welcome goes to our keynote speakers, Dr. Mohd. Sazali Khalid (from University Tun Hussein Onn Malaysia), Prof. Dr. Janchai Yingprayoon (Suan Sunandha Rajabhat University, Thailand), Rabeta bt. Mohd. Salleh, Ph.D (University Sains Malaysia), Dee-Jean Ong (R.E.A.L. Education Group Malaysia) and Dr. Anna Ratna Wulan (from Universitas Pendidikan Indonesia).

The special welcome also goes to all invited speakers from top Universities all over Indonesia.

This seminar, The 3rd International Seminar on Trends in Science and Science Education 2016 is an annual seminar organized by Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Medan. This is the third year seminar following the succesful first and second year seminar held in 2014 and 2015. This year seminar is focusing on the contribution of research to the development of technology. The committee expects the information exchange among researchers in this seminar will encourage collaboration among the different actors in science and science education community so as to achieve a better result for the benefit of the community. This third annual international seminar will be held from October 7 - 8, 201.

The committee are really honored to have attention from approximately 200 speakers and participants from three different countries. They come from Thailand, Malaysia and of course Indonesia. About 20 universities from all over Indonesia participate in this event. It is expected that those who participate in the seminar will afterwards be familiar and able to interact with their international counterparts in their scientific area. This is in line with the vision of Universitas Negeri Medan to become a world class and character building university.

The committee recieved more than 100 seminar abstracts and full papers from science education, biology, chemistry, physics, and mathematics sciences. Most of the abstract have been edited and bound into an abstract collection book which is a part of the seminar kit. The seminar full papers are now in editing stage by the committee before publish in seminar proceeding that will be available in both printed and on-line forms, in the next January 2017. Please, remind the committee if you want to get the copy of the seminar proceeding.

This year seminar is a special event because it is held together with the annual meeting of all mathematics and natural science faculties from LPTK in



Indonesia or Forum MIPA LPTK Indonesia. The meeting will be held from October 7-9, 2016, in Medan and Parapat. This forum is intended to built collaboration among LPKT's in Indonesia.

I would like to take this opportunity to acknowledge the important role of the honorable Prof. Dr. Syawal Gultom, M.Pd, rector of Universitas Negeri Medan for giving us his full support and attention and for providing his precious time to be with us and to honour us by opening this seminar.

Our sincere thanks also goes to the honorable Dr. Asrin Lubis, M.Pd, Dean of Fakultas Matematika dan Ilmu Pengetahuan Alam, who havelead and encourage all the committeemembers to be always focused and worked hard even in a very short period of time to prepare the seminar.

My sincere thanks also goes to all members of the committee and to all staff of Fakultas Matematika dan Ilmu Pengetahuan Alam for their continuous support and hard work because without their assistance this seminar may not have taken place today.

Finally, I conclude my speech by kindly inviting Honourable Prof. Dr. Syawal Gultom, M.Pd, Rector of Universitas Negeri Medan, to give special direction and officially open the seminar. We wish you good luck and success in this endeavor.

Thank you very much

Prof. Dr. Herbert Sipahutar, MS., M.Sc. Chairman AISTSSE 2016



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### The Development of Active Learning Approach on Mathematics Subject Integrated with Character Education in Junior High School

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**ABSTRACT:** The objectives are: (1) comprehensively examining theories which are used to develop active learning approach integrated with character education by following its research model phases and development; (2) comprehensively examining of whether or not the learning tools suited to active learning approach integrated with character education. The research is conducted through learningtoolss development stages. Learning tools development process uses 4-D model modification; it is based on Thagarajan Semmel & Semmel which is consisted of defining, designing, developing, and disseminating. Findings obtain: (1) Contextual learning tools is able to bring out character values, (2) Character values particularly in social environment is able to be obtained through cooperative learning tools.

KEYWORDS: Active Learning Approach, Mathematics Learning, Character Education.

#### 1. INTRODUCTION

Character education is an integral part that needs to be concerned on educational process particularly on mathematics subject. On *Kebijakan Nasional Pembangunan Karakter Bangsa* 2010-2025, it is formulated that character education is ideally implemented through four pillars called the teaching-learning process activities, daily activities in the form of cultural development of educational unit, co-curricular activities and/or extracurricular, along with daily activities at home and community. Character education on teaching-learning activities can be conducted through subjects'integrated approach in order to experience instructional effects and nurturant effects for students' character development.

In order to strengthen character education implementation on education unit, the Ministry of education has defined 18 values of cultural education and nation character which are sourced from religion, Pancasila, culture, national education objective, namely: (1) religious, (2) honest, (3) tolerant, (4) discipline, (5) hard work, (6) creative, (7) independent, (8) democratic, (9) curious, (10) national spirit, (11) love the country, (12) appreciate the achievement, (13) friendly/communicative, (14) love peace, (15) interest in reading, (16) environmental care, (17) social care, (18) responsibility. Every education unit is able to decide which character value will be highlighted and suited to characteristics of school/ class, province, or subjects.

The integration of character education on mathematics subject could be implemented by designing active learning approach activities which is explicitly and implicitly able to shape certain character value. This approach is chosen due to embed the character in which the students have to actively play roles in the learning process.

If it associated with curriculum 2013, active learning approach is a learning design: (1) the learning process on studentcentered; (2) interactive learning process (teacher-students-environment-sources/other media); (3) multimedia tools-based learning process; (4) team work-based learning process, (5) students' character value development affected by the learning process [2].

Referring to the criteria above, this research identified two active learning approaches called (1) Contextual Teaching Learning (CTL); and (2) Cooperative Learning.

Contextual learning presents character values. Contextual learning characteristic is a constructivism learning concept which is started by presenting daily problems at school or home, processing asking questions, finding, learning community, modeling, and doing authentic reflection and assessment [3]. This contextual problem is expected to encourage the students to construct their knowledge and comprehension.

Contextual learning is a learning concept functioning the teacher as a planner and learning implementer to compose materials (content) and connect it with understandable circumstances. The teacher has to relate the materials taught with students' real life situation, along with encourage them to position themselves as the family and society [4].

The character values particularly on social environment is gained through cooperative learning design. The cooperative learning is based on social constructivism concept. This learning model emphasizes on students grouping on small groups to work in a team for solving problems, accomplishing assignments or making things to reach the goals [5]. Cooperative learning is developed to obtain three important goals, those are: (1) enhancing students' performance on academic tasks. The experts

argued that this model excel in assisting students to figure out difficult concept; (2) accepting individual differences. Cooperative learning is adapted to wider acceptance circumstance towards different people according to race, culture, social class, ability and inability; (3) developing social skill. The cooperative learning model aims at teaching the students about teamwork and collaboration skills [6].

Based on topic/content/material aspects of mathematics at middle schools or the three aspects of active learning approach, it can be identified somecharacter values which are explicitly and implicitly able to be built, developed and formed on mathematics learning session, they are called: conscientious, creative, never give up, curious, independent, confidence, tolerance, responsibility, appreciate achievement, communicative, open-minded, collaborate to learn each other, take and give, respect, discipline, hard work, think logically, critical, honest, consensus, independent, consistent, universality, obedience, objectivity, accuracy, truth, focus on objectives, viable, able to make quick and accurate decision, and do self-reflection [1], [7], [8].

Therefore, it is clear that mathematics could facilitate character values development and formation for contributing the national character development. The educators' implementablestrategy are identifying character values that can be developed from topics/ materials of mathematics subject that would be taught, choosing appropriate learning approach to develop and form the values, creating role model in implementing the values and later to be evaluated.

In implementing the strategy on mathematics subject, it needs conceptual and empirical review through a research for developing a learning model with active learning approach integrated with character education. The developed learning model is to optimize students' role as a subject and to optimize the teaching and learning process result in the form of increasing students' ability along with forming students' character as instructional effects and nurturant effects.

This research is tend to design and develop the learning tools model with active learning approach integrated with character education, those are: (1) comprehensively examining theories used to develop active learning approach model integrated with character education through following the research model phases and its development; (2) comprehensively assess of whether or not the developed learning tools is appropriate to active learning approach model which is integrated with character education.

#### 2. THE RESEARCH METHOD

This research is to develop the learning tools such as the lesson plan, learning media, students' activity sheet (LKPD), and students' book.

The development model which is used to develop the learning tools is Four-D model [9]. This model has been chosen for more systematic and suitable to develop the learning tools, yet the researcher modified the 4-D model. The model simplification is from the four steps to three steps, they are defining, designing, and developing. Disseminating step has not been applied due to the research objective which is to develop the learning tools thus it can gain better learning tools generating on developing step.

The instruments are validation sheet, teachers' competence observation sheet and students' activities observation sheet (LKPD), and learning achievement test. Data analysis is a validation result analysis of learning tools, teachers' competence analysis in learning management, and students' activities analysis on learning process.

#### 3. FINDINGS AND DISCUSSION

#### A. Description of Defining Stage

#### 1) Front-End Analysis

Observation and interview results show that the learning process is on conventional pattern in which it is dominated by the teachers. On this learning process, the teacher explains the concept of math, gives examples, and asks the students do some exercises. Thus, the students tend to be passive and it does not give any chances to construct their own knowledge.

Based on interview result gained from mathematics teacher show thatSMP students' mastery in mathematics is still low, it is based on students' cognitive theory to actively involved in learning for constructing knowledge in order not to easily forget. One of the learning alternatives is to activate students through active learning approach.

In implementing active learning approach, it needs suitable learning tools. Its reason, the learning tools at school is currently not available, thus it is necessarily developed suitable learning tools to support the learning process.

#### 2) Students' Analysis

This analysis found some as the following:

- Social cultural backgrounds are diverse. Parents' job of the students are diverse e.g. as a teacher, a civil servant, a
  farmer, a labor, a trader, an entrepreneur, and so forth. The school and students' home living are in the part of
  Gorontalo District.
- The age of students in SMP Negeri 1 Limboto is around 11-15 year old. Looking at the stage of students' cognitive development, Piaget stated that these students have already been at formal operational stage.

 Based on students knowledge background, the sub matter subject like TeoremaPhytagoras, coordinate system, and statistic learned by the students at class VIII SMP Negeri 1 Limboto are not the new lesson since this sub subject has been taught at the elementary school (SD). Besides, these materials are experienced on students' daily life as well.

#### 3) Material Analysis

This analysis aims at identifying the subject matter parts that would be learned on Teorema Phytagoras, coordinate system, and statistic at class VIII SMP referring to curriculum 2013.

#### Task Analysis

This analysis covers general and specific tasks. The general task refers to major competence and basic competence in curriculum 2013. The specific task refers to the modification of students learning achievement indicators.

#### 5) Specification of Learning Objective

The specification of learning objective is done by elaborating basic competence into accomplishment of specific learning achievement which is based on material analysis and task analysis.

#### B. Description of Designing Stage

#### 1) Media Selection Result

The learning media for implementing active learning approach is suited with material analysis, task analysis, specification of learning objective and the facilities in SMP Negeri 1 Limboto. Based on the analysis, media is chosen on active learning for those materials which comprised to board, marker, LCD, laptop, computer laboratory.

#### 2) Format Selection Result

The format selection for learning tools is suited with principal, characteristic, and cooperative learning and contextual learning stages. The learning stages consisted of preliminary, core, and final activities. Students' activity sheet (LKPD), task, and learning achievement test are created in color expecting it would attract and encourage them to study.

#### 3) Initial Designing Result

At this stage, it generates initial design of the lesson plan for 3 meetings, students' book, students' activity sheet (LKPD), learning achievement test in which these are for each material of statistics, Teorema Pythagoras, and coordinate system. All result on designing stage is called Draft I.

#### C. Description of Development Stage Result

#### 1) Expert Validation Result

Validating expert is focused on format, matter, illustration, and language that cover all developed learning tools. Expert validation result is such correction, critical, and suggestion which is done as basic to revise and polish up the learning tools. The revision result of learning tools based on validators is called Draft II. The three validators give good and very good assessment. The three validators deduce that lesson plan can be used with little revision.

2) Validation Result and Students' Activity Sheet Result (LKPD)

Validators' assessment towards LKPD comprised to: manual tasks and information. The expert validation results toward LKPD give good and very good assessment. The three validators deduce that LKPD can be used with little revision. Therefore, students' book can be revised by validators' suggestion.

3) Validation Result and Students' Book Revision

The assessment done by validators for LKPD covers: format, language, illustration, and matter. Validators give good and very good assessment. The four validators deduce that teachers' manual book can be used with little revision. Therefore, students' book can be revised by validators suggestion.

#### 4) Readability Test

Before conducting the experiment, first of all readability test is conducted towards the Draft II on 6 students in SMP Negeri 1 Limboto. These students are not taken from the experiment classes. All the results on these readibility tests are called draft III. The input gain from readability test is the incorrect words of LKPD. Revision is done to rectify the LKPD in order to make the students easier interpreting problems or tasks given and resolving them.

#### 5) Learning Tools Test

The test aims at improving the learning tools, before it is used at experiment class. The test is conducted on six meetings in accordance with the lesson plan. The test is also followed by 2 observers where each of themis in charge on observing students' activities and teachers' competence in learning management. The observer of teacher competence is at the back side of the classroom and the observer of students' activities is right beside of the students. The researcher acts as the general observer who generally observes the learning process. The experiment data gained areanalyzed and the result is used as consideration to revise the Draft III for better and qualified tools.

The data gained are students' activities data and teachers' competence in classroom management data. Based on teachers' competence criteria in managing class assigned, the teachers' competence in each meeting on three experiment classes is on minimal good category. Meanwhile, students activities analysis observed on each lesson plan are on tolerance limit of ideal time criteria.

Hence, it concludes that students' activities are effective.

#### 4. CONCLUSION AND SUGGESTION

#### A. Conclusion

- Based on topic/content/material aspects of mathematics at middle schools or the three aspects of active learning approach, it can be identified some character values which are explicitly and implicitly able to be built, developed and formed on mathematics learning session, they are called: conscientious, creative, never give up, curious, independent, confidence, tolerance, responsibility, appreciate achievement, communicative, open-minded, collaborate to learn each other, take and give, respect, discipline, hard work, think logically, critical, honest, consensus, independent, consistent, universality, obedience, objectivity, accuracy, truth, focus on objectives, viable, able to make quick and accurate decision, and do self-reflection.
- 2. The integration of character education into mathematics learning process is conducted by designing the learning activities through active learning approach which explicitly and implicitlyform the character values.
- 3. The contextual learning tools that have been arranged can present character values.
- 4. Particular character values in social can be gained through cooperative learning tools design

#### **B.Suggestion**

- 1. Active learning approach integrated with character education needs to be implemented on mathematics subject in order to form students' character.
- 2. Further research is needed to examine the arranged learning tools efficacy particularly when it relates to school's characteristic, different social circumstances and different mathematics topics.

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