



ISSN : 2548 - 4613  
Vol. 4. Desember 2019

# Proceedings

## **The 4th Annual INTERNATIONAL SEMINAR on Transformative Education and Educational Leadership**

Theme : Education Innovation in Indonesia Context Focused  
on Disruptive Technology of Industrial Revolution 4.0.

23 - 24 September 2019  
Garuda Plaza Hotel - Jln. Sisingamangaraja No. 18  
Medan, North Sumatra - Indonesia



Supported by :



## Committee

### Advisors

Dr. Syamsul Gultom, S.KM.,M.Kes (Rector of Unimed)  
Prof. Dr. Bornok Sinaga, M.Pd (Director of Postgraduate Program of Unimed)  
Prof. Dr. Sahyar, MS.,MM (Vice Director 1 of Postgraduate School of Unimed)  
Dr. Darwin, M.Pd (Vice Director 2 of Postgraduate Program of Unimed)

Conference Chairperson	: Dr. Rahmad Husein, M.Ed
Secretary	: Dr. Juniastel Rajagukguk, M.Si
Trasurer	: Dedi Agus Syahputra, SE
Secretariat	: Vivi Emilawati, SE.,M.Si
	1. Erika, S.Pd.,M.Pd
	2. Nurul Fazrika, S.Pd.,M.Pd
	3. Amir Husin Sitompul, S.Pd.I
	4. Agus Harriyanto
Papers and Proceedings	: 1. Dr. R. Mursid, ST.,M.Pd
	2. Dr. Anni Holila Pulungan, M.Pd
	3. Dr. Saronom Silaban, M.Pd
	4. Dr. Tumiur Gultom, M.Si
	5. Mangaratua Simanjorang, M.Pd.,Ph.D
	6. Indra Hartoyo, S.Pd.,M.Hum
	7. Dra. Meisuri, MA
	8. Dr. Hermawan Syahputra, M.Si
Program/Event	: 1. Dr. E. Elvis Napitupulu, M.Si
	2. Dr. Rachmat Mulyana, M.Si
	3. Dr. Elmanani Simamora, M.Si
Plenary Session	: 1. Prof. Amrin Saragih, M.A.,Ph.D
	2. Prof. Dr. Abinus Silalahi, M.S
	3. Prof. Dr. Abdul Hasan Saragih, M.Pd
Moderator for Parallel :	1. Prof. Dr. Edi Syahputra, M.Pd
	2. Prof. Dr. Anita Yus, M.Pd
	3. Prof. Dr. Paningkat Siburian, M.Pd
	4. Dr. Edy Surya, M.Si
	5. Dr. Fauziyah Harahap, M.Si
	6. Dr. Rahmatsyah, M.Si
	7. Dr. Arif Rahman, M.Pd
	8. Dr. Ir. Nurfajriani, M.Si
	9. Dr. Hidayat, M.Si
	10. Dr. Fitrawaty, SP.,M.Si
	11. Dr. Albadi Sinulingga, M.Pd
	12. Dr. Abdurrahman Adisaputera, M.Hum
	13. Dr. Imran Ikhmad, M.Pd
	14. Dr. Arfan Ikhsan, M.Si
	15. Dr. Saidun Hutasuhut, M.Si
	16. Dra. Jubliana Sitompul, M.Hum
Poster Session	: 1. Dr. Anni Holila Pulungan, M.Hum

2. Dr. Syamsidar Tanjung, M.Pd
  3. Dr. Sukarman Purba, M.Pd
  4. Dr. Ajat Sudrajat, M.Si
  5. Dr. Ratih Baiduri, M.Si
  6. Dr. Muhammad Fitri Ramadhana, M.Si
  7. Dr. Mulyono, S.Si.,M.Si
  8. Dr. Daulat Saragi, M.Hum
  9. Dr. Tumiur Gultom, SP.,MP
  10. Dr. Derlina, M.Si
  11. Dr. Wisman Hadi, M.Hum
  12. Dr. Nurhayati Simatupang, M.Kes
  13. Dr. Amir Supriadi, M.Pd
  14. Ali Fikri Hasibuan, SE.,M.Si
  15. Drs. Thamrin, M.Si
  16. Junita Friska, S.Pd.,M.Pd
- Public relations : 1. Muhammad Surip, S.Pd.,M.Si  
2. Jihan Siska
- Accommodation : 1. Ater Budiman Sinaga, M.Si  
2. Hendry Dalimunthe, MA  
3. Yandri Imanuel Siburian, SE., M.Si.  
4. Jasmi Assayuti, SHi
- Equipment : 1. Eko Budiarto  
2. Sofianto Gultom  
3. Suhana Nasution  
4. Farid Ma'ruf Harahap  
5. Isachar Adry Utomo  
6. Diky Arisandi  
7. Herianto Samosir, S.Pd  
8. Ahmad Rosyadi Nasution, S.Pd  
9. Hizrah Saputra Harahap, S.Pd  
10. Muhammad Isnaini, M.Pd  
11. Nasiruddin, S.Pd
- IT & ICT : 1. Jerry S. Pauned, S.Si  
2. Mulyanto Duha
- Transportation : 1. Hisar P. Sianturi, SH  
2. Sari Purnamawati Siregar, M.Hum  
3. Yutia Hafwenny, S.KM
- Consumption : 1. Fitria Ramadhani  
2. Azizi Apri Indaya, S.Pd  
3. Susiani, S.Sos  
4. Siti Rohana, M.Pd  
5. Yutia Hafweny, S.KM  
6. Tiarna Nova, M.Pd.
- Receptions : 1. Nisa Ansyari Gultom, S.Pd  
2. Desi Yulian, S.Pd  
3. Siti Rohana, S.Pd.,M.Pd  
4. Cecilia Tampubolon, S.Sos

**Rundown of The 4<sup>th</sup> Annual Internatioanal Seminar on Transformative Education and Educational Leadership (AISTEEL) 2019**  
**Garuda Plaza Hotel, Medan, 23 – 24 September 2019**

**1st day (Monday, September 23, 2019)**

Time	Activities	PIC
15.00 – 20.00	Registration in Garuda Plaza Hotel	committee

**2nd day (Tuesday, September 24, 2019)**

Time	Activities	PIC/Moderator
07.00 – 08.30	Poster Sessions 1	Section Poster 1
08.30 - 09.00	<b>Opening Ceremony</b> 1. MC Speech 2. Traditional Welcome Dance 3. Indonesian National Anthem 4. Pray 5. Chairperson Report 6. <b>MoU signing between Unimed and PSU - Thailand</b> 7. Welcoming speech of Director of Postgraduate School 8. Welcoming speech and official opening of Rector of State University of Medan	MC
09.00 – 09.40	Plenary Lecture 1: <b>Prof. Dr. Syawal Gultom, M.Pd</b> (State University of Medan– Indonesia)	Moderator Section
09.40 – 10.25	Plenari Lecture 2 <b>Prof. W. L. Quint Oga-Baldwin</b> (Department of Education, Faculty of education and Integrated Art and Sciences, Waseda University - Japan)	Prof. Amrin Saragih, PhD (Panel)
10.30 – 11.15	Plenari Lecture 3 <b>Prof. Dr. Wu-Yuin Hwang</b> (Graduate Institute of Network Learning Technology National Central University, NCU - Taiwan)	
11.15 – 12.00	Plenari Lecture 4 <b>Prof. Dr. Ekkarin Sungtong</b> (Dean of Faculty of Education Prince of Songkla University - Thailand)	Mangara Simanjorang, PhD (Panel)
12.00 – 12.45	Plenari Lecture 5 <b>Asst. Prof. Patcharin Panjaburee, Ph.D.</b> (Mahidol University – Thailand)	
<b>12.45 – 13.30</b>	<b>Lunch Break/</b> Poster Sessions 2	Section Poster 2
<b>13.30 – 15.30</b>	<b>Parallel Session 1</b>	
15.30 – 16.00	Break/ Poster Sessions 3	Section Poster 3

15.50 – 18.00	<b>Parallel Session 2</b>	Moderator/Operator
18.00 – 19.00	Break/ Prayer	
19.00 – End	Banquet (Gala Dinner) - Announce of Best Presenter - Announce of Best Poster	Consumption Section

## **Proceedings of the 4<sup>th</sup> Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2019)**

### **Preface**

The 4<sup>th</sup> Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2019) was held in Garuda Plaza Hotel, Medan City-Indonesia on 23-24 September 2019. This seminar is organized by Postgraduate School, Universitas Negeri Medan and become a routine agenda at Postgraduate program of Unimed now.

The AISTEEL is realized this year with various presenters, lecturers, researchers and students from universities both in and out of Indonesia participating in, the seminar with theme “Education, Learning and Leadership Innovation.”

The plenary speakers coming from various provinces in Indonesia have been present topics covering multi disciplines. They have contributed many inspiring inputs on current trending educational research topics all over the world. The expectation is that all potential lecturers and students have shared their research findings for improving their teaching process and quality, and leadership.

The fourth AISTEEL presents a keynote speaker and 4 distinguished invited speakers from Indonesia, Japan, Taiwan, and Thailand. In addition, presenters come from various Government and Private Universities, Institutions, Academy, and Schools. Some of them are those who have sat and will sit in the oral defence examination.

There are 310 articles submitted to committee, some of which are presented orally in parallel sessions, and others are presented through posters. The articles have been reviewed by double blind reviewer and 172 of them were accepted for published by Atlantis Press indexed by International Indexation and 96 papers are published by digital library indexed by google scholar.

The Committees of AISTEEL invest great efforts in reviewing the papers submitted to the conference and organizing the sessions to enable the participants to gain maximum benefit.

Grateful thanks to all of members of The 4<sup>th</sup> Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2019) for their outstanding contributions. Thanks also given to publisher for producing this volume.

The Editors

**Bornok Sinaga**  
**Rahmad Husein**  
**Juniastel Rajagukguk**

## *Table of Content*

<b>Title And Authors</b>	<b>Page</b>
Learning Media Development of Foklore Text Which is Based on Digital in the 10th Grade of Vocational High School PAB 1 Helvetia <i>Yogi Andriyan Zunaeidy</i>	1-3
Translation Shift in the English Version of Musabaqah Tafsir Quran <i>Muhajirah Binti Jamaluddin</i>	4-8
Types of Lexical Creation in Iis Dahlia's Slang Words in Mamaku Hits <i>Filzah Farhana Hasibuan</i>	9-12
The Effect of Learning Strategies and Achievement Motivation on Entrepreneurship Learning Outcomes of Scout Special Unit Education and Culture Program BP-PAUD and DIKMAS Sumatera Utara <i>Johanes Pasaribu</i>	13-16
Analysis of Student's Science Process Skill on Respiration System Topic in Langsa City- Aceh <i>Ajeng Lola Prianti</i>	17-20
Meaning Equivalence in Abdullah Yusuf Ali's Translation of Surah al waqiah from English into Indonesian <i>Wirdatul Mardhiah</i>	21-22
Developing an Authentic Assessment Instrument of Exposition Text Based on Higher Order Thinking Skills (HOTS) in Class X Students of Senior High School <i>Yuli Novita Sari</i>	23-26
Sentence Acquired by Children of 2 – 2.6 Years Old in Bilingual Environment <i>Laura Agustina Simamora</i>	27-29
Development of Study Peripheral Base on the Realistic Approaches to Increase Ability of Mathematical Reasoning of Student Junior High School State 6 Medan <i>Melisa</i>	30-35
Effectiveness of Ecology and Environment Textbook Based on Science Literacy and North Sumatra's Local Potency to Improve High School Student Science Literacy <i>Ivandi Sitompul</i>	36-39
Deposit Determinant Analysis in Bank Sumut <i>Mangaradot Saur A Sinaga</i>	40-47
Development of Teaching Materials Based on Guided Discovery Learning Methods to Increase Mathematical Problem Solving Ability <i>Rianta Ananta Sitepu</i>	48-55
Development of Mathematical Learning Devices Based on Model Problem Based Learning (PBL) to Improve Mathematical Communication Skills of School IT Jabal Noor Students Class VII	56-65

*Rizka Putri Rahayu*

Development of Thematic Teaching Materials Based on Local Culture at The Fourth Grade of Primary Schools in North Padang Lawas District 66-69

*Rahimul Harahap*

The Maintenance of Mandailing Language Kecamatan in Torgamba

*Putri Nurul Rahmadani Siregar* 70-76

Enhancing Students Mathematical Conceptual Understanding by Applying Guided Discovery Learning and Direct Learning Model 77-82

*Sri Rahwany Marbun*

Development of Learning Devices Based on Realistic Mathematic Education to Improve Mathematical Communication of Students at Senior High School 83-86

*Karina Hajar Hutasuhut*

The Developing of Interactive Learning Media in Improving The Learning Creativity of 4-6 Year-Old Playgroup Students in PAUD Kenanga Raya Medan 87-89

*Romi*

The Influence of Learning Approaches and Interest in Learning Against the Results of Learning English in Class VIII Medan SPK Middle School T.A 2018/2019

*Juni Triana Sitompul* 90-94

Determinant Analysis of Sharia Banking Efficiency in Indonesia

*Rahmat Putra Ahmad Hasibuan* 95-99

The Development of Interactive Instructional Media Based on Behavioral Perspective to Improve the German Skills of Senior High School Students Grade X 100-102

*Hadijah Handayani Sibuea*

Development of Guided Inquiry Green Chemistry Practicum Guides 103-106

*Ekin Dwi Arif Kurniawan*

The Development of Adobe Flash Media Integrated Problem Based Learning on Salt Hydrolysis 107-110

*Indriati Aulia*

The Effect of Learning Strategy and Interpersonal Communication on the Students Achievement Reading Comprehension English Language at SMP Negeri 1 Selesai Kabupaten Langkat Tahun Ajaran 2018 / 2019 111-115

*Husna Lubis*

Cognitive Consideration in Persuading Readers in Argumentative Writing 116-119

*Betharia br. Sembiring Pandia*

The Role of the Single Mother of Parenting in Informal Education in Javanese Ethnic Families in Kualuh Hulu District Labuhanbatu Utara Regency 120-122

*Suriyanti Siagian*

Understanding of Female Prisoners Character Education Through Formal 123-125



Socialization at Labuhan Ruku Penitentiary

*Dian Puspita Sari Sirait*

Local Wisdom-Based Education Marsialapari Salak Farmers Sibangkua Angkola Barat Tapanuli Selatan 126-128

*Desy Andarini*

Rituals at the Tomb of Datuk Darah Putih as a Media for Nonformal Education to Respect Ancestors (Case Study Chinese Ethnic in Aur Village Medan Maimun District Medan City) 129-131

*Gadis Anastasia*

Interactive Multimedia-Based Learning Materials Innovation for Teaching Basic Techniques in Analysis 132-134

*Yuni Chairani*

The Effect Model of Learning and Learning Interest Against the Results of Learning the Knowledge of Nature Primary School (SD) in Medan T.A 2019/2020 135-139

*Mida Lishanata*

Development of Interactive Media in Arabic on the Material Read Class VIII of MTs Darul Hikmah T.A 2019/2020 140-143

*Nurul Amri*

The Influence of Leadership Behavior, Work Motivation, Job Stress, and Job Satisfaction on Lecturers' Performance 144-146

*Hanafiah*

Developing Big Book as Reading Materials Based on Thematic Approach for Fourth Grade Students at SD Negeri 028068 Binjai East Binjai Regency Langkat 147-149

*Utari*

The Development of Textbook Based on Research About the Insect Pollinator on Chili Paper (*Capsicum annum L.*) 150-154

*Fitriatul Aspahani*

Gratitude Expressions and Responses used by the Characters in the Vow Movie 155-158

*Sabrina Octavia Pandingan*

Subtitling Strategies Used in The Meg Movie Texts 159-164

*Devi Sucina Nirwana*

Lexical Metaphor in Novel and Film Critical Eleven 165-167

*Indah Christiani Silitonga*

The Types of Modality in Teaching Learning Process 168-169

*Harnida Tanjung*

The Effect of Teaching Strategies and Students Motivation on Reading Comprehension Achievement 170-173

*Zulkarnain Batu Bara*

The Types of Flouting Maxim by Governor Candidates of North Sumatera in Election Debate 2018	174-176
<i>Tri Wita Indah Sari</i>	
The Effect of Teaching Strategies and Students' Interest on Reading Comprehension of Recount Text of Eighth Grade Students of MTs Qur'an Kisaran	177-179
<i>Ahmad Fauzi</i>	
Flouting Maxims in the Courtroom of Administrative Court	180-182
<i>Aminah Ari Fadhila</i>	
Development of Adobe Flash Learning Media Based on Cooperative Learning to Improve Student's Spatial Ability at Chandra Kumala Secondary School	183-188
<i>Fajar Sukma Harsa</i>	
Improving Results in Learning Bahasa for Poetry Readings with the Implementation of a Direct Learning Model for Fifth Grade Elementary School	189-192
<i>Dr. Mayske Rinny Liando, S.Pd., M.Pd</i>	
Development of Learning Materials Based on Problem Based Learning to Improve Students Problem Solving Ability	193-197
<i>Poppy Amalia</i>	
Analysis Of The Economic Bilateral Relationship Indonesia – China On Balance Of Payments In Indonesia	198-201
<i>Sri Wulandari</i>	
Community Participation in Preservation of City Park The Case of Binjai City, Indonesia	202-204
<i>Widya Afriani Wiliskar</i>	
The Types of Gender Arguments in Instagram (A Case Study of Donald Trump's Political Status)	205-207
<i>Putri Permata Sari Samosir</i>	
The Analysis of Monetary Policy Transmission Mechanism by Exchange Rate Channel in Influencing The Inflation in Indonesia	
<i>Putry Sari Rahmadyah Pulungan</i>	208-214
Translation Technique Applied in Translating the First Call from Heaven Novel	215-222
<i>Sudariyani</i>	
Education Cultural in Bona Pasogit (Ethnographic Study of Education Cultural Inheritance in the Toba Batak Society Marga Panjaitan in Pematangsiantar)	223-225
<i>Tripresar Jhon Tuan Panjaitan</i>	
Evaluation Of Tiered In Order To Increase PAUD Teacher Competence In Medan City	226-230
<i>Rehmenda Christy</i>	
Women Politeness Strategies of Bargaining "Media Credit Store" in Tanjung	231-233

Morawa

*Nahdyah Sari Daulay*

Toba Batak Language Shift in Rantau Selatan

*Helfi Vinawari S*

234-236

Development of Interactive Multimedia Digital Storytelling in English Subjects

237-239

*Juanda*

The Effect of PLAN (Plan, Locate, Add and Note) Strategies on Students' Achievement in Reading Comprehension

240-244

*Neneng Nurhamidah*

Unggah-Ungguh Code Switching in Kartini Movie

*Yutika Sari*

245-247

Metaphors in Umpasa of the Toba Batak Wedding Ceremony

248-250

*Sactica Oktavyani Sagala*

The Effect of Model learning and Gender Against Piano playing Skills for class V SMK Negeri 11 Medan T.A 2019/2020

251-255

*Gufran Nurman*

The Effect of Cooperative Learning Model Based on Aceh Culture to Improve the Generic Science Skills of Student

256-260

*Safitri Raufa*

Gender Conversation in Workplace Context

*Aisyah Fitriani Dasopang*

261-265

Management and Development Quality of Teacher Performance Through Teacher Competence in the First Middle School in Banda Aceh

266-268

*Faisal Anwar*

Modality used in Beauty Product Advertisements on Instagram Caption

269-272

*Indah Eka Sari*

Attitudinal Appraisal in Ahok's Speech

*Firdha Sabrina*

273-276

Appraisal Attitudes by the Judges on Indonesian Idol "Grand Final" Session

*Mieta Setieya*

277-280

The Development of Virtual Laboratory-Based Learning Media of Biology on The Topic of Bacterial for High School Students

281-284

*Lailatussyifa*

Analysis of Economic Opening on Rupiah Exchange Rate on United States Dollars (2008-2018)

285-289

*Sri Wahyuni*

The Manners of Cognitive Process in Translating English Phrasal Verbs Into

290-293

Indonesian

*Fitri Ervina Tarigan*

Javanese Addressing Terms Maintenance by the Teenager Speakers in Bukit Malintang 294-298

*Sudarti Rahayu Ningsih*

Appraisal in Students' Argumentative Writing 299-302

*Ika Vanesia Siagian*

Speech Pauses Used by Male and Female Students in English Oral Examination 303-305

*Lamia Deareni*

The Development of Guidance and Integrated Science Practicum Kit Integrated Guided Inquiry Model bases Science Process Skills for Class VII Semester I 306-309

*Fretty Nafratilova Hutahaeen*

Analysis of Biomolecular Practicum Guides According to KKNi Curriculum 310-313

*Nurul Indah Pratiwi*

The Cognitive Process of Different Gender in Writing Argumentative Text 314-318

*Surya Teriadi Tarigan*

The Development of Chemistry Lab Guide Book for High School Based on Guided Inquiry to Measure Scientific Attitudes and Science Process Skill 319-325

*Gorat Victor Sibuea*

The Unnaturalness of the Translatio of Indonesian Tourist Resorts Signs Into English in Parapat and Bukit Lawang 326-328

*Iis Aprianti*

Grammatical Error of Speech by Students in Bilingual Program of Ma'had Al Jami'ah UIN North Sumatra 329-332

*Riyah Shibha Nasution*

Speech Functions Used by Male and Female Tour Guides in Their Touring Interaction with Tourists in Bukit Lawang 333-336

*Widya Ningsih*

Analysis of the Influence of Economic Openness to Indonesia Growth 337-340

*Zando Silaban*

Design Development and Standard Operational Procedure for Training Model Management of 3 Diploma Mechanical Engineering University of Medan 341-345

*Mindo Judica Pangaribuan*

The Euphemism in "Sambah Manyambah" Tradition of Minangnese Wedding Ceremony 346-348

*Muhammad Fauzi*

Analysis of Factors That Influence the Interdiction of District/City in the Province 349-354

North Sumatra

*Muhammad Yulhelmy Isra*

Development of Interactive Learning Media Based on Adobe Flash CS 6 in Geographic Lessons 355-360

*Mardimpu Sihombing*

The Comparison between Predict Observe Explain (POE) and Think Pair Share (TPS) Learning Model on Students Learning Achievement, Activity, and Critical Thinking Skill on Human Circulatory System 361-367

*Remli Nelmian Simarmata*

Metaphor Translation in English and Indonesian Version of Surah Ali Imran 368-371

*Uswatun Hasanah*

# Development of Learning Materials Based on Problem Based Learning to Improve Students Problem Solving Ability

Poppy Amalia

Post Graduate Mathematics Education  
State University of Medan  
Medan, Indonesia  
email:amaliapoppy@gmail.com

Asrin Lubis

Mathematics Education  
State University of Medan, Indonesia

Hasratuddin

Mathematics Education  
State University of Medan, Indonesia

**Abstract**—Problem Based Learning is a set of teaching models that use problems as a focus for developing problem solving skill. The purpose of this study is the produce qualified learning materials which is developed based on Problem Based Learning and analyze the improvement of students mathematic problem solving ability which is learned using Problem Based Learning materials. This research is a development research using the Thiagarajan 4-D development model. Trials of learning materials based on Problem Based Learning were conducted three times to obtain quality devices. Based on the analysis, Problem Based Learning based learning materials that are taught have good quality at the stage of dissemination and the ability to solve mathematical problems learned by using Problem Based Learning devices is increased during the disseminate stage. The results of the analysis of the data obtained indicate that Problem based Learning materials can improve mathematical problem solving ability.

**Keywords**— 4-D model, development of learning materials, problem based learning, mathematical problem solving ability

## I. INTRODUCTION

In the world of education, mathematics is one of the subjects that plays an important role in helping develop the potential of students. Studying mathematics can help students to think and study things logically and systematically. This is consistent with what [1] mathematics is a method of logical thinking. Mathematics is a condition with values that can shape the personality and character needed to face the challenges of a competitive age and demand professionalism. This is in line with what [2] "Mathematics is a science and intuition that strengthens belief, which is very important and useful in everyday life and in supporting the development of human resources and also helps develop logical, planned, objective, objective and rational thinking patterns and is very competent. , So everyone needs to learn".

[3] "Problem solving has a special importance in study of mathematics. A primary goal of mathematics teaching and learning is development the ability to solve a wide variety of complex mathematics problems".But the facts show that students' mathematical problem solving abilities are still low. The low level of mathematical problem solving abilities of students was also found in this study. Based on the results of

observations that have been made, it is found that students' problem solving abilities are classified as low.

Here, students immediately develop mathematical models and apply strategies to solve problems. But in terms of solving problems students are still not thorough in calculations. Then from the results of interviews with teachers it is known that the teacher is not accustomed to solving problems by writing what is known in the problem. However, NCTM also revealed the first indicator of problem solving ability was identifying the elements that were known, which were asked and the adequacy of the elements needed. Thus to train students to understand the problem, the teacher must train students to identify the known elements in the problem.

Given the importance of mathematical problem solving skills that students must master after learning mathematics and facts that show students 'low mathematical problem-solving abilities, steps need to be taken to improve students' mathematical problem solving abilities.

To solve the above problems, teachers are required to be able to find and find a way that is able to optimize problem solving ability. One of them is by reforming the learning materials and student learning strategies.. According to [4] "Instructional materials play a very important role in teh teaching and learning process". The importance of device learning in learning activities is also supported by research by Nwike & [5] "From the findings the study, it can be seen that students taught with instructional materials performed better than those who taught without. It was therefore recommended that instructional materials be used in teaching because it has positive impact on student' performance".

Learning materials will facilitate students to be actively involved in developing their potential. The quality of the development of learning materials according to [6] includes "validity, practically and effectiveness". "The strategy of teaching good students plays an important role in addition to mastering the teacher about the content of mathematics" [7]. One strategy by choosing a learning model that has the opportunity to improve problem solving skills is Problem Based Learning.

## II. THEORETICAL FRAMEWORK

### A. Mathematical Problem Solving Ability

Problem solving abilities according to [8] OECD are: *Problem-solving skills, i.e. the capacity of students to understand problems situated in novel and cross-curricular settings, to identify relevant information or constraints, to represent possible alternatives or solution paths, to develop solution strategies, and to solve problems and communicate the solutions.*

[8] mentions that there are 4 standards in solving problems “*Built new mathematical knowledge through problem solving, solve problem that arise in mathematics and in other contexts, apply and adapt a variety of appropriate strategies to solve problems and monitor and reflect on the process of mathematical problem solving*”. To solve a problem, a problem solver can use the strategy or steps formulated by [9] namely:

First, we have to understand the problem; we have to see clearly what is required. Second, we have to see how various items are connected, how the unknown is linked to the data, in order to obtain the idea of solution, to make a plan. Third, we carry out our plan. Fourth, we look back at the completed solution, we review and discuss it.

Then in this study, the problem solving process was used through three stages, namely “Understanding the problem, solving the problem and answering the problem” adapted from Polya's three problem solving processes. The use of this problem solving process is due to “the Charles, Lester and O’Daffer scale and its modified forms are easy to use” an advantage of such a scale is that a teacher may focus on only one of the stages [10]. As for the modified scale:

TABLE 1. SCALE ANALYSIS FOR PROBLEM SOLVING INDICATORS

ANALYTIC SCALE FOR PROBLEM SOLVING
<p><b>Understanding the Problem</b></p> <p>0 – No attempt</p> <p>1 – Completely misinterprets the problem</p> <p>2 – Misinterprets major part of the problem</p> <p>3 – Misinterprets minor part of the problem</p> <p>4 – Complete understanding of the problem</p>
<p><b>Solving the Problem</b></p> <p>0 – No attempt</p> <p>1 – Totally inappropriate plan</p> <p>2 – Partially correct procedure but with major fault</p> <p>3 – Substantially correct procedure with minor omission or procedural error</p> <p>4 – A plan that could lead to a correct solution with no arithmetic errors</p>
<p><b>Answering the Problem</b></p> <p>0 – No answer or wrong answer based upon an inappropriate plan</p> <p>1 – copying error , computational error, partial answer for problem with multiple answer; no answer statement; answer labeled incorrectly</p>

2 – Correct solution

From the descriptions above, it can be concluded that mathematical problem solving ability is the ability possessed by students in solving mathematical problems in applying the knowledge previously obtained into new situations by paying attention to the process of finding answers based on the steps of problem solving namely understanding the problem, make a settlement plan and solve the problem.

### B. Problem Based Learning

According to [11], Learning based on problems is the interaction between stimulus and response, is the relationship between the two directions of learning and the environment. The environment provides input to students in the form of assistance and problems, while the brain's nervous system functions to interpret the aid effectively so that the problems faced can be investigated, assessed, and analyzed, and the solutions are sought well. Student experience gained from the environment will make him material and material in order to gain understanding and can be used as guidelines and learning goals.

[12] "Problem-based learning is a set of teaching models that use problems as a focus for developing problem solving skills". In line with that, [13] "Problems in PBM are problems that are ill-structure or contextual and engaging, thus stimulating students to ask questions from various perspectives". From the above descriptions it can be concluded that the Problem Based Learning model is a learning model that begins with contextual problems and involves students in the problem solving process.

### C. Learning Materials

[14] “Instructional materials are essential and significant tools needed for teaching and learning of school subjects to promote teachers’ efficiency and improve students’ performance”. Based on the description above, the learning materials can be interpreted as a number of materials or tools that students and teachers will use in the learning process. Furthermore, the development of learning materials is a process carried out to produce a series of learning materials used by teachers and students in the learning process in the classroom. In this study, the learning tools developed were teacher books, student books, student worksheets, tests of mathematical problem solving abilities and student self-efficacy.

## III. RESEARCH METHOD

This research is development research. This study uses the development model of Thiagarajan, et al which is also often referred to as 4-D, covering four stages, namely defining, designing, developing and disseminating. This research was conducted at SMK Swasta Ar-Rahman Medan,

which is one of the high schools in Medan, North Sumatra, Indonesia. The subjects in this study were students of class XI TKJ 1, XI TKJ 2, XI TKJ 3 and XI AK.

To analyze the improvement of students' mathematical problem solving abilities, data were obtained from the results of students' pre-test and post-test. Improving students' mathematical problem solving skills can be obtained from the t-test related to the sample, as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2} - 2r\left(\frac{S_1}{\sqrt{n_1}}\right)\left(\frac{S_2}{\sqrt{n_2}}\right)}}$$

#### IV. DATA ANALYSIS, RESULT AND DISCUSS

##### *The Description of Learning Materials Development Stages*

In this development research, problem-based learning-based learning materials have met the quality of effective learning tools in trial II and can be applied at the deployment stage which is tested for effectiveness before being disseminated. The final draft has been obtained at the disseminate stage. The results of the development of learning materials using the Thiagarajan 4-D model are explained as follows.

##### *Stage 1-Define*

This stage includes five main steps, namely: (a) initial preliminary analysis; (b) student analysis; (c) concept analysis; (d) task analysis; and (e) formulation of learning objectives. Based on observations of learning materials, there are some weaknesses in the learning device used by the teacher, because the teacher has not developed according to the characteristics of students, such as in the teacher's book and books students have not provided contextual problems, and the teacher does not use student worksheets as support for learning activities. Furthermore, in the learning process the teacher still uses direct learning during the learning process, and the teacher is also not accustomed to giving motivation to students in solving problems given. This results in students appearing less active during learning and having good self-efficacy.

##### *Stage 2-Design*

At this stage the initial draft lesson plan was produced for 3 meetings, teacher books, student books, student worksheets and tests of mathematical problem solving ability based on the specifications of the learning objectives and indicators of ability measured, the tests developed are adjusted to the cognitive level of the students. All results at this design stage are called draft I

##### *Stage 3-Develop*

At this stage, the draft I which has been revised by experts is tested on the class outside the research subject. The aim is to see weaknesses in draft I so that it can be revised and refine the learning material developed. Expert validation results in the form of content validity assessment which shows that all learning tools meet valid criteria, with the total average value of the validation teacher books being 4.61, 4.55 student books, and 4.54 student worksheets. All items test students' mathematical problem solving ability meet valid criteria and can be used. Instrument reliability is used to determine test results. After calculation, the reliability of the math problem solving ability is 0.838 (high category).

After the learning device developed has met the validity criteria, the learning device in the form of draft II is tested in the subject and place of research, hereinafter referred to as the trial I. Based on the results of the first trial data analysis, it was found that the learning tools developed did not meet all the effective criteria, so that improvements were needed to produce learning materials that met all the effective criteria set. The revision is based on the findings of the weaknesses of the learning device in the first trial, which is that the sentence sentences in the student book are less understood by students. After the revision was completed, the second trial was conducted to determine the effectiveness of the learning device, as well as improving the mathematical problem solving ability.

##### *Stage 4-Disseminate*

The development of learning materials reaches the final stage if it has obtained positive values from experts and through development tests. The learning materials are then package distributed and determined for a wider scale. But in this study the disseminate stage was not carried out, so the fourth stage was not explained.

##### *Result of Trial I*

From the results of the trial data analysis I, it is known that the learning device developed has not been effective, because there are still a number of indicators of effectiveness that have not been achieved, namely in the first trial the percentage of classical completeness achieved was 68.75%, which means that it has not met the criteria for achieving mastery in a classical manner, other than that it is only questions 1) a, 1) b and item 2) a course that reaches the criteria for achieving a learning goal of at least 75%. While the indicators of effectiveness that have been fulfilled in the trial I are the achievement of learning time, namely the learning time used during the trial I is the same as ordinary learning and student responses, namely students respond positively to the components of the learning system Problem Based Learning developed. Based on the results of the analysis from the trial I, it is known that the learning device developed has not met all the effective criteria, this is caused



by several factors, among others, from the teaching and learning process that has not been able to be carried out optimally. Furthermore, other factors that also affect failure to meet effective criteria are the learning materials used, so that it needs to be revised to several components in the hope that Problem Based Learning materials can improve students' and students' mathematical problem-solving ability.

#### *Result of Trial II*

After conducting the first trial on the second draft, further improvements were made to produce a learning device that fulfilled all the effective criteria set. The results of the revision in the draft II produced a draft III which was then tested on class XI TKJ 2 students.

The development of learning materials reaches the final stage if it has obtained positive values from experts and through development tests. After learning materials are developed, they have met the effectiveness criteria through trials. Based on the results of data analysis, learning developed materials developed Learning tools developed based on Problem Based Learning for class XI were obtained during distribution. The learning materials has met the criteria of valid, practical and effective. This is indicated by (1) The implementation of learning by using the device is in a good category and the level of implementation is 88.66; (2) Classical completeness is achieved where students complete 86.67%; (3) Achieved learning objectives where students who have at least moderate problem-solving abilities are 80%; (4) A total of 96.67% of students have a positive response to the components of the learning device; (5) The time used in the application of learning materials based on Problem Based Learning, does not exceed ordinary learning. The students' mathematical problem solving abilities learned by using learning materials based on Problem Based Learning increased during the dissemination stage with an average of 81.50. Thus, the problem-based learning materials developed can already be deployed to a wider stage.

#### *DISCUSSION*

Development of Problem Based Learning materials in this study was carried out in accordance with the 4-D development model procedure. Learning materials that are developed must be of good quality, that is fulfilling valid, practical and effective criteria [21]. Based on the results of the posttest II trial analysis it was found that students' mathematical problem solving abilities met these effective criteria because the materials and problems in the student book and activity sheets were developed according to the characteristics and environment of students. This is in accordance with Ausubel's learning theory which states that meaningful learning is the process of connecting new information or material to concepts that already exist in one's cognitive structure [11] Research related to problem-based

learning (PBL) conducted by [20] there is an increase in problem solving abilities taught by problem-based learning models in test I 0.312 and in trial II 0.441.

Student learning completeness is also influenced by the learning model used in the learning process, which is a problem-based learning model that makes students interested in learning and actively involved in the learning process. The same thing stated by [19] "Improving the ability of mathematical problem solving students who receive the application of problem-based learning models is better than students who accept conventional learning". Then [15] "problem solving abilities of students using a problem-based learning model are better than conventional learning". This is also supported by the results of [6] "The results of the study show that the application of problem-based learning models can improve students' problem solving and self-efficacy skills". Based on the results of research and support from the previous research above, it can be seen that the problem-based learning tools developed can help students in learning.

Naturally, if an increase in problem solving skills is taught mathematics through problem-based learning, because problem-based learning uses contextual problems so that students are easier to understand and able to develop knowledge gained from personal experience. This is supported by the theory of [16] which emphasizes social experience and skills, where the learning process will occur if children work, handle tasks that have not been studied, but the task is still within their reach so that children can solve problems by developing self-efficacy. Furthermore, [17] added that social interaction with other people both teachers and peers can build new ideas and improve students' intellectual development. Student learning completeness is also influenced by learning models used in problem-based learning processes that make students interested in learning and actively involved in the learning process [18]. This is in line with the results of the research of [18] learning materials developed are effective in terms of student learning completeness. The category of learning outcomes effectiveness is effective if many students achieve 85% classical completeness. With each indicator increasing at the end of the meeting in learning. [3] problem solving has important meaning in mathematics learning. The main purpose of learning mathematics is to develop complex mathematical problem solving skills. Therefore, in mathematics learning the ability to solve problems is very important.

#### V. CONCLUSION

Based on the results of analysis and discussion in this study, it can be concluded that learning materials based on Problem Based Learning have met the criteria of quality (valid, practical and effective) and the ability to solve mathematical problems has increased. This study shows that learning materials based on Problem Based Learning are important things that need to be considered in an effort to

maximize students' mathematics learning achievements. Thus, it is expected that mathematics teachers can use this learning model by making quality materials in mathematics learning at school.

#### ACKNOWLEDGMENT

This research was supported by my supervisors Dr. Asrin Lubis, M.Pd and Prof. Dr. Hasratuddin, M.Pd. And the author would like to thank family for their continuous support and encouragement.

#### REFERENCES

- [1] Suriasumantri, J.S. (2012). *Filsafat Ilmu Sebuah Pengantar Populer*. Jakarta: Pustaka Sinar Harapan.
- [2] Hasratuddin. (2018). *Mengapa Harus Belajar Matematika?*. Medan: Penerbit Perdana Publishing.
- [3] Yuwono, A. 2016. Problem Solving dalam Pembelajaran Matematika. *UNION: Jurnal Pendidikan Matematika* Vol.4 No. 1.
- [4] Effiong, Ekpo, O & Igiri C.E. (2015). Impact of Instructional Materials in Teaching and Learning of Biology In Senior Secondary Schools In Yakurr LG. A. *International Letters of Social and Humanistic Sciences*. ISSN 2300-2697 Vol. 62 pp 27-33. DOI.
- [5] Nwike, M C. & Catherine, O. 2013. Effects of Use Instructional Materials on Students Cognitive Achievement In Agricultural Science. *Journal of Educational and Social Research*. Vol. 3(5) August 2013. ISSN 2239-978X. Doi:10.5901/jesr.2013.v3n5p103.
- [6] Rokhmawati, Diah, J., Djatmika, E. & Wardana, L. (2016). Implementation of Problem Based Learning Model to Improve Students' Problem Solving Skill and Self-Efficacy (A Study on IX Class Students of Smp Muhammadiyah). *IOSR Journal of Research & Method in Education (IOSR-JRME)* e-ISSN: 2320-7388,p-ISSN: 2320-737X Volume 6, Issue 3 Ver. IV (May. - Jun. 2016), PP 51-55 www.iosrjournals.org
- [7] OECD. (2016). *PISA 2015 Results (Volume I): Excellence and Equity in Education*, PISA. Paris: OECD Publishing
- [8] NCTM. (2000). *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics (NCTM).
- [9] Polya, G. (1973). *How To Solve It (2nd ed)*. Princeton: Princeton University Press
- [10] Szetela , W & Nicol, C. 1992. *Evaluating Problem Solving in Mathematics*. New York: Cambridge University Press.
- [11] Trianto. (2009). *Mendesain Model Pembelajaran Inovatif-Progresif. Konsep Landasan, dan Implementasinya pada Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta: Kencana Prenada Media
- [12] Eggen, P & Kauchak, D. (2012). *Strategi dan Model Pembelajaran Mengejar Konsten Keterampilan Berfikir*. Jakarta: Indeks.
- [13] Ismailmuza, D. 2010. *Kemampuan Berpikir Kritis dan Kreatif Matematis Siswa SMP Melalui Pembelajaran Berbasis Masalah dengan Strategi Konflik Kognitif*. Disertasi. Bandung: Tidak Diterbitkan.
- [14] Olayanki, A. R. B. (2016). Effects of Instructional Materials on Secondary Schools Students' Academic Achievement in Social Studies in Ekiti State, Nigeria. *World Journal of Education*, 6(1), 32-39. <http://dx.doi.org/10.5430/wje.v6n1p32>
- [15] Sahyar & Fitri, R.Y. (2017). The Effect Problem Based Learning Model (PBL) and Adversity Quotient (AQ) on Problem-Solving Ability. *American Journal of Education Research*. Vol. 5 No. 2.
- [16] Vygotsky, L. S. (1978). *Mind in Society: The Development of the Higher Psychological Processes*. Cambridge, MA: The Harvard University Press.
- [17] Arends, R.I. (2008). *Learning to Teach. Buku Dua*. Edisi Ketujuh.Yogyakarta: Pustaka Pelajar.
- [18] Amalia, E., Surya, E. & Syahputra, E. (2017). The Effectiveness of Using Problem Based Learning (PBL) in Mathematics Problem Solving Ability for Junior High School Students. *IJARIE-ISSN (O)-2395-4396,Vol-3 Issue-2 2017*.
- [19] Eviyanti, C Y., Surya, E., Syahputra, E & Simbolon, M. (2017). Improving The Students' Mathematical Problem Solving Ability By Applying Problem Based Learning Model in VII Grade at SMPN 1 Banda Aceh Indonesia. *International Journal Of Novel Research In Education and Learning*. Vol. 4 Issue 2, pp (138-144).
- [20] Surya, E. & Syahputra, E. (2017). *Improving High-Level Thinking Skills by Development of Learning PBL Approach on The Learning Mathematics for Senior High School Students*. International Education Studies; Volume 10, Number. 8 2017.
- [21] Nieveen, N. 2007. *An Introduction to Education Design Research*. China: The east China Normal University.

