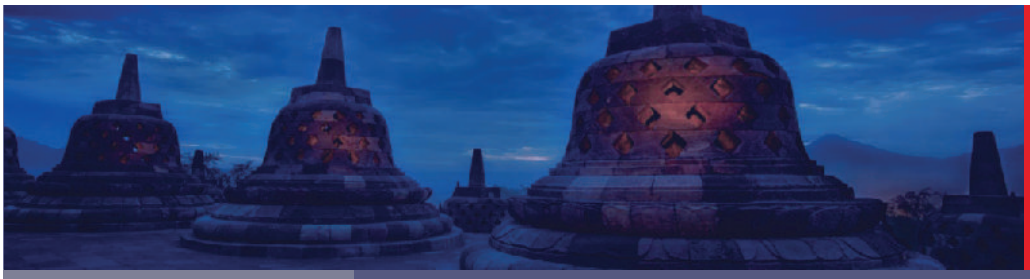

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BACKGROUND

In its effort to improve the quality of education in Indonesia, the Indonesian government has imposed Curriculum 2013 on schools of all level in Indonesia. The main difference between Curriculum 2013 and the previous curriculum lies in its implementation which uses the scientific approach. For the reason, teachers need to develop teaching strategies different from those they used to apply in the implementation of the previous curriculum. Besides, teachers also need to develop the techniques of evaluating students' learning achievement, which are relevant to the scientific approach. The evaluation has to be able to show the students' learning achievement in observing, experimenting, social networking, etc.

Authentic assessment conducted in the classroom and focusing on complex and contextual tasks enables students to perform their competence in a more authentic arrangement. It is very relevant to the authentic approach integrated in their teaching process, especially at elementary schools, or for appropriate lessons. It must be able to show which attitude, skill, and knowledge have or have not been mastered by the students, how they use their knowledge, what aspect they have or have not been able to apply, and so on.

On the basis of the above consideration, teachers can identify what materials the students can study further and for what material they need to have a remedial program. Authentic assessment, however, is not that easy!

FOREWORD

In the academic year of 2014, the government in this case the Ministry of Education and Culture has established the policy to run the curriculum of 2013 for the all levels of elementary and intermediate education in Indonesia. It means the schools have to be ready to implement the Curriculum of 2013. Basically, the implementation of the 2013 curriculum is an effort from the government to enhance the quality of education.

One of the characteristics of the 2013 curriculum is make use the scientific approach in the learning process. This approach is to improve the students' creativity in learning. In general, this approach seems to be a new thing for the teachers in which several problems and obstacles appear in its practice. The teachers are required to develop the learning strategies and the assessment systems which are relevant and appropriate in order to nurture the students' creativity. One of the assessment methods that can support the concept of scientific approach is by sing the authentic assessment. Authentic assessment can give the description of the knowledge, the attitudes, and the skills as well as what has or has not owned by the students and the way they apply their knowledge. Also, in what case they have or have not been able to implement the learning acquisition.

Based to the above circumstances, the Study Program of Educational Research and Evaluation, Graduate School of Yogyakarta State University (Universitas Negeri Yogyakarta) conduct the international seminar on the theme "Classroom Assessment for Improving Teaching Quality". There will be three sub-themes on this seminar, i.e. Issues of Classroom Assessment Implementation, Implementation of Authentic Assessment, and Developing a Strategy of Creative Teaching. By having this seminar, the participants are expected to possess the knowledge and the skills to develop and to apply the authentic assessment.

Yogyakarta, November 8, 2014
Head of Committee

Prof. Dr. Sudji Munadi

CONTENTS:

	pages
Title ……	i
Background ……	ii
Foreword ……..…….…….	iii
Welcome Speech …….....……..…….	iv
Preface …….. ……	v
Content ……..…..	vi

Invited Speaker

ISSUES OF CLASSROOM ASSESSMENT IMPLEMENTATION Madhabi Chatterji …….…….	2
IMPLEMENTATION OF AUTHENTIC ASSESSMENT Pongthep Jiraro…….……..	11
DEVELOPING A STRATEGY OF CREATIVE TEACHING Paulina Panen…….…….	23

Paper Presenter

Theme 1:
Issues of Classroom Assessment Implementation

ASSESSMENT IN DEVELOPMENT COMPUTER-AIDED INSTRUCTION Abdul Muis Mappalotteng ……	35
THE MEASUREMENT MODEL OF INTRAPERSONAL AND INTERPERSONAL SKILLS CONSTRUCTS BASED ON CHARACTER EDUCATION IN ELEMENTARY SCHOOLS Akif Khilmiyah……..	47
LEARNING ASSESSMENT ON VOCATIONAL SUBJECT MATTERS OF THE BUILDING CONSTRUCTION PROGRAM OF THE VOCATIONAL HIGH SCHOOL IN APPROPRIATE TO CURRICULUM 2013 Amat Jaedun ……..	63
ACCURACY OF EQUATING METHODS FOR MONITORING THE PROGRESS STUDENTS ABILITY Anak Agung PurwaAntara ……	74

EFFECT OF PERFORMANCE ASSESSMENT ON STUDENTS'THE ACHIEVEMENT IN PHYSICS HIGH SCHOOL 86
Aswin Hermanus Mondolang ……...

TEST ITEM ANALYSIS PROGRAM DEVELOPMENT WITH RASCH MODEL ONE PARAMETER FOR TESTING THE ITEM DIFFICULTY LEVEL OF MULTIPLE-CHOICE TEST USING BLOODSHED DEV C ++ APPLICATIONS 93
Dadan Rosana, Otok Ewi Amsirta ……

EFFECTIVENESS OF REASONED OBJECTIVE CHOICE TEST TO MEASURE HIGHER ORDER THINKING SKILLS IN PHYSICS IMPLEMENTING OF CURRICULUM 2013 101
Edi Istiyono, Djemari Mardapi, Suparno ……

DEVELOPING STUDENTS' SELF-ASSESSMENT AND STUDENTS' PEER-ASSESSMENT OF THE SUBJECT-MATTER COMPETENCY OF PHYSICS EDUCATION STUDENTS 111
Enny Wijayanti, Kumaidi, Mundilarto ……..

THE RESULT OF ASSESSMENT FOR STUDENTS IN SOLVING EXPONENTS AND LOGARITHMS PROBLEMS (CASE STUDY IN GRADE X CLASS MATHEMATICS AND NATURAL SCIENCE (MIA) 2 STATE SENIOR HIGH SCHOOL 1 DEPOK 2014/2015) 123
Fajar Elmy Nuriyah ……..

RELIABILITY RANKING AND RATING SCALES OF MYER AND BRIGGS TYPE INDICATOR (MBTI) 131
Farida Agus Setiawati …….

THE COMPARISON OF ITEMS' AND TESTEES'ABILITY PARAMETER ESTIMATION IN DICHOTOMOUS AND POLITOMUS SCORING (STUDIES IN THE READING ABILITY OF TEST OF ENGLISH PROFICIENCY) 139
Heri Retnawati ……...……

STUDENTS' CHARACTER ASSESSMENT AS A REFERENCE IN TEACHING LEARNING PROCESS AT SMPK GENERASI UNGGUL KUPANG 151
KorneliusUpa Rodo, Netry E.M. Maruckh, Joko Susilo ……..

MEASUREMENT ERROR ESTIMATION OF CUT SCORE OF ANGOFF METHOD BY BOOTSRATP METHOD 157
Sebastianus Widanarto Prijowuntat ……..

THE ACTUALIZATION OF PROJECT-BASED ASSESSMENT IN ENTREPRENEURSHIP EDUCATION BASED ON LOCAL EXCELLENCE IN MEASURING SKILLS OF VOCATIONAL HIGH SCHOOL STUDENTS 168
Sukardi ……..

THE EFFECTIVENESS OF THE USE OF THE INSTRUMENTS AND RUBRICS OF CREATIVE THINKING SKILLS–BASED ASSSESMENT PROJECT IN THE LEARNING OF CONSUMER EDUCATION 177
Sri Wening …….

PROJECT WORK USED IN A COMPREHENSIVE ASSESSMENT TO MEASURE COMPETENCES OF UNDERGRADUATE ENGINEERING STUDENTS 194
Sudiyatno……

THE DEVELOPMENT OF A SET OF INSTRUMENT FOR STUDENT PERFORMANCE ASSESSMENT 202
Supahar …….

DEVELOP MODEL TASC TO IMPROVE HIGHER ORDER THINKING SKILLS IN CREATIVE TEACHING 210
Surya Haryandi ……..

THE EFFECT OF NUMBER'S ALTERNATIVE ANSWERSON PARTIAL CREDIT MODEL (PCM) TOWARDESTIMATION RESULT PARAMETERS OF POLITOMUS ITEM TEST 216
Syukrul Hamdi ……..

THE CONTENT VALIDITY OF THE TEACHER APTITUDE INSTRUMENT 227
Wasidi ……...

DEVELOPING COGNITIVE DIAGNOSTIC TESTS ON LEARNING OF SCIENCE 233
Yuli Prihatni …….

DIAGNOSTIC MODEL OF STUDENT LEARNING DIFFICULTIES BASED ON NATIONAL EXAM 246
Zamsir, Hasnawati ……..…….

DEVELOPMENT OF A MODEL OF ACADEMIC ATTITUDE AMONG SENIOR HIGH SCHOOL STUDENTS 258
Sumadi .....

Theme 2:
Implementation of Authentic Assessment

IMPLEMENTATION OF AUTHENTIC ASSESSMENT OF CURRICULUM 2013 AT STATE ELEMENTARY SCHOOLS IN PABELAN 265
Abdul Mu'in, NiningMarianingsih, WoroWidyastuti …….

AUTHENTIC ASSESSMENT OF STUDENT LEARNING MATHEMATICS WITH TECHNOLOGY 278
Ida Karnasih …….

AUTHENTIC ASSESSMENT : UNDERSTANDING LEVELS AND CONSTRAINTS IN THE IMPLEMENTATION OF THE TEACHER IN THE CITY OF LHOKSEUMAWE ACEH PROVINCE 286
M. Hasan ……..

AUTHENTIC ASSESSMENT DETERMINANT IN ISLAMIC RELIGION EDUCATION EXECUTION TOWARDS COGNIZANCE QUALITY HAVES A RELIGION IN STUDENT AT ELEMENTARY SCHOOL AND MADRASAH IBTIDAIYAH AT KUDUS REGENCY 295
Masrukhin .....

AUTHENTIC ASSESSMENT FOR IMPROVING TEACHING QUALITY: PORTFOLIO AND SLC IN PAPUA HARAPAN SCHOOL 307
Noveliza Tepy, Sabeth Nuryana, Putri Adri …….

Theme 3:
Developing a Strategy of Creative Teaching

THE EFFECT OF MATH LESSON STUDY IN TERMS OF MATHEMATICS TEACHER'S COMPETENCE AND MATH STUDENT ACHIEVEMENT 319
'AfifatulMuslikhah ……...

AN EVALUATION OF THE ENGLISH TEACHING METHODS IMPLEMENTED AT BUJUMBURA MONTESSORI PRIMARY SCHOOL: WEAKNESSES AND ACHIEVEMENTS 323
Alfred Irambona ……...

TEAMS GAME TOURNAMENT FOR IMPROVING THE STUDENTS' INTEREST TOWARD MATHEMATICS 331
Anggit Prabowo …..……..

DEVELOPING LEARNING KIT TO IMPROVE HOTS FOR FLAT SIDE OF SPACE COMPETENCE 346
Arifin Riadi ……

DEVELOPMENT STRATEGYOF TEACHERS' TEACHING PROFESSIONALISM 352
Bambang Budi Wiyono ……

THE EFFECT OF QUESTION PROMPTS AND LANGUANGE ABILITY ON THE QUALITY OF THE STUDENT'S ARGUMENT 364
BambangSutengSulasmono, HennyDewiKoeswanti ……

THE USE OF RESPONSE ACTIVITIES IN DEVELOPING READING SKILLS AMONG INTERMEDIATE EFL STUDENTS 378
Beatriz Eugenia Orantes Pérez …….

COMPARISON OF THE EFFECTIVENESS OF CONSTRUCTIVISM AND CONVENTIONAL LEARNING KIT OF MATHEMATICS VIEWED FROM ACHIEVEMENT AND SELF CONFIDENCE OF STUDENTS IN VOCATIONAL HIGH SCHOOL (AN EXPERIMENTAL STUDY IN YEAR XI OF SMK MUHAMMADIYAH 2 YOGYAKARTA) 389
DwiAstuti, Heri Retnawati ……...

THE EFFECT OF CLASS-VISITATION SUPERVISION OF THE SCHOOL PRINCIPAL TOWARD THE COMPETENCE AND PERFORMANCE OF PANGUDI LUHUR AMBARAWA ELEMENTARY SCHOOL TEACHERS 394
Dwi Setiyanti, Lowisye Leatomu, Ari Sri Puranto, Theodora Hadiastuti, Elsavior Silas……..

THE 'REOP' ARCHITECTURE TO IMPROVE STUDENTS LEARNING CAPACITY 403
Edna Maria, Febriyant Jalu Prakosa, Christiana, Monica Ganeip Pertiwi ....

E-LEARNING-BASED TRAINING MODEL FOR ACCOUNTING TEACHERS IN EAST JAVA 408
Endang Sri Andayani, Sawitri Dwi Prastiti, Ika Putri Larasati, Ari Sapto ...

CONCEPT AND CONTEXT RELATIONSHIP MASTERY LEARNING AND THE RELATIONSHIP BETWEEN BIOLOGY AND PHYSICS CONCEPT ABOUT MANGROVE FOREST 431
Eva Sherly Nonke Kaunang ……..

THE EFFECTIVENESS OF TEACHING MULTIMEDIA ON TOPIC OF THREE DIMENSIONS IN TERMS OF THE MATHEMATICS LEARNING ACHIEVEMENT AND INTEREST OF STATE SENIOR HIGH SCHOOL 439
Lisner Tiurma, Heri Retnawati …….

BUILDING THE STUDENT CHARACTER THROUGH THE ACADEMIC SERVICE 448
M. Miftah ……..

THE TEACHING EVALUATION OF GERMAN TEACHER IN MALANG 464
Primardiana Hermilia Wijayati .....

SUPPORTING PHYSICS STUDENT LEARNING WITH WEB-BASED ASSESSMENT FOR LEARNING 479
Sentot Kusairi, Sujito …….

AMONG LEARNING AS A CULTURE BASED LEARNING OF TAMAN MUDA TAMAN SISWA AS CONTRIBUTION TO THE LEARNING PROCESS OF 2013 CURRICULUM AND CHARACTER EDUCATION OF THE NATION 490
Siti Malikhah Towaf ……..

THE PERFORMANCE OF THE BACHELOR EDUCATION IN-SERVICE TEACHERS PROGRAMME (ICT-BASED BEITP) BACHELOR GRADUATED AND ITS DETERMINANT 513
Slameto …….

DEVELOPING LEARNING TOOLSOF A GAME-BASED LEARNING THROUGH REALISTIC MATHEMATICS EDUCATION (RME) FOR TEACHING AND LEARNING BASED ON CURRICULUM 2013 525
Sunandar, Muhtarom, Sugiyanti ……...

PREPARATION OF COMPUTER ANIMATION MODEL FOR LEARNING ELECTRICAL MAGNETIC II PHYSICAL EDUCATION PROGRAM STUDENTS SEMESTER IV TEACHER TRAINING AND EDUCATION FACULTY SARJANAWIYATA TAMANSISWA UNIVERSITY 2014 536
Sunarto ……...

IMPROVEMENT ACTIVITIES AND STUDENT LEARNING OUTCOMES IN READING COMPREHENSION THROUGH COOPERATIVE LEARNING TYPE TEAMS-GAMES-TOURNAMENT (TGT) CLASS V SD NEGERI 8 METRO SOUTH 547
Teguh Prasetyo, Suwarjo, Sulistiasih ……

PSYCHOLOGICAL FACTOR AFFECTING ENGLISH SPEAKING PERFORMANCE FOR THE ENGLISH LEARNERS IN INDONESIA 558
Youssouf Haidara …….

DEVELOPING LEARNING KIT TO IMPROVE HOTS FOR FLAT SIDE OF SPACE COMPETENCE

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Abstract

This research was aimed to develop a learning kit for flat side of space competence to improve higher-order thinking skills using problem-based learning, consisting of valid, practical, and effective syllabuses, lesson plans, worksheets, and the valid and reliable of evaluation instrument i.e. test. The research is a development research (research & development), which was carried out by the implementation of Borg & Gall (1983) development model, which modified into three stages: preliminary study, product design, and development and evaluation. The result of validation by expert jugdement shows that the developed learning kit is feasible to use with valid category. The aspects of practicality was falls into practical category based on observation of learning implementation, and teacher's and student's assessment. The aspect of effectiveness could be reached from the student's HOTS. The result of field tryout shows that student's HOTS category gets A at SMP Negeri 1 Daha Utara and B at SMP Negeri 2 Daha Utara.

Keywords: *development, higher-order thinking skills, problem-based learning*

Introduction

Higher-order thinking skills (HOTS) was really important for students because the characteristic of real life problems was complex, illstructured, novel, and needs thinking skills more than just aplicates what was studied. Students should be creative for making solutions of the problems what they faces in society. On the other hand, in UU number 20 year 2003 section 3 clarifed that one of the functions and purposes of national education is developing student's potential to become human that have devout and pious to the one and only God, kind character, healthy, scholarly, skillful, creative, stand alone, and become democratic and responsible citizen.

Based on those laws, it's clearly known that higher-order thinking skills or we called HOTS of student's potential should be developed and improved. So, learning activity should be focus on reaching those HOTS.

Curriculum of 2013 today have prospects on inquiry-based learning by students (Permendikbud No.65 year 2013a, p.3). One of the suitable alternative learning models is

problem-based learning, because Rusman (2011, p.234) said problem-based learningmakes teachers focusing their attention on developing inquiry skill.

Problem-based learning, or PBL for short, is one of the learning model that can improves student's problem solving skill. This thing explained by Herman (2007, p.52) on result of his research that in PBL activity, student's activity to learn was greater than teachers. Students commonly shows their great spirit and diligent for solving problems, actively discussing and helping each others in team, and not awkwardly asking questions or directions to the teaches.

HOTS like explained by Thomas & Thorne (Higher level thinking-It's HOT!, p.1) is thinking on higher level than just memorizing facts. HOTS requires students to do something with the facts. They must understand them, connect them to each other, categorize them, manipulate them, put them together in new or novel ways, and apply them as they seek new solutions to new problems.

HOTS in mathematics learning is very important, as clarified on BSNP (2006, p.139) that mathematics subjects gived to students to makes them have logical, analytic, systematic, critical, and creative thinking, also teamwork skill. On those documents also clarified that mathematics learning in school have purpose to make students have problem solving skills include skill of understanding problems, creating mathematics models, solving those models, and explaining solutions that was reached.

Mathematics learning, especially in junior high schools, also concerns on developing and improving HOTS. This thing explained on standar isi untuk satuan pendidikan dasar dan menengah (BSNP, 2006, p.140) that one of the purposes of mathematics learning in junior high schools is manipulating mathematics to makes generalisation, arranges evidence, and solves problems include skill of understanding problems, creating mathematics models, solving those models, and explaining solutions that was reached.

Based on TIMSS (Trends in international mathematics and science study) 2011 and PISA (Program for international student assessment) 2009 result show that Indonesia have lower position of 65 states, with weaknesseson (1) understanding complex imformation, (2) theorizing, analysing, and solving problem, (3) using tool and procedure to solve problem, and (4) doing investigation (Winataputra, 2013, p.6). This show that student's HOTS commonly still in low level.

In addition, based on Puspendik data about national examination report in last 3 years show that junior high schools state in Hulu Sungai Selatan regency getting lower significantly on graduate level, especially from year 2012 to 2013. Those result show that even total

students not graduated from year 2011 to 2012 decrease from 7 students (0.304%) become 1 student (0.040%), those number increase significantly for year 2012 to 2013 become 40 students (1.723%).

Based on those result show the important of teachers character on improving mathematics skills, especially student's HOTS. This conclusion supported by preliminary study was conducted on two junior high schools state in Hulu Sungai Selatan regency, i.e. SMP Negeri 1 Daha Utara and SMP Negeri 2 Daha Utara. Based on the result of HOTS test presented in those schools show that student's HOTS of 8th class whose contain total 97 students was not good yet. This conclusion can be seen from Table 1 below.

Table 1. Student's HOTS in Preliminary Study

HOTS Aspect	Score mean	Maximum score	Reachness rate (%)
Analysing	0.041	2.000	2.041
Evaluating	0.000	2.000	0.000
Creating	0.173	4.000	4.337
Critical thinking	0.378	2.000	18.878
Problem solving	0.122	2.000	6.122

Based on interview result of those two schools show that the teachers agree about focusing their learning for HOTS, but in the field reality they not implementing those learning yet. This result also supported by literature study result about learning kit what teachers uses, that until now teachers still using learning kit which is not specifically guide students for improving HOTS.

One of the efforts we can do to solving those problem is developing good lesson plan and specifically focus on student's HOTS. This thing agree with government law number 19 year 2005 section 19 poin 3 about lesson plan, including learning kit.

One of the learning model which is support in improving student's HOTS is PBL. This conclusion supported by research result conducted by Setiawan, Sugianto, & Junaedi (2012). The conclusion of their research show that activity and attitude of students in PBL can improve HOTS.

So, it's important to doing research about developing mathematics learning kit for improving HOTS in 8th class of junior high schools using PBL as one of the supporting alternative learning model.

Research Method

This kind of research is Research & Development. Developmental model used is Borg & Gall (1983) model which is modified into three stages, containing preliminary study,

product design, and development and evaluation. This research conducted in SMP Negeri 1 Daha Utara and SMP Negeri 2 Daha Utara from April to May of 2014.

The subjects on readness study is 12 students and 6 teachers from combination of two schools from the place which is research conducted. The subjects on field tryout is 22 students from SMP Negeri 1 Daha Utara and 15 students from SMP Negeri 2 Daha Utara.

Analysis of the data in this study aims to answer the research questions. Data in the form of comments and suggestions were analyzed qualitatively, which are then used as input to revise the products developed. While the data obtained through the validation sheet, sheet teacher assessment, student assessment sheets, observation sheets feasibility study conducted, and evaluation instruments in parametric statistical analysis. To assess the feasibility of learning tools are developed in terms of validity, practicality, and effectiveness.

Data in the form of comments and suggestions were analyzed quantitatively, which is then used as the basis for revising the products developed. Data in the form of the rating scale of 5 is converted into qualitative data also scales 5. Categories of data conversion is performed based on the categories presented in Table 2 below (Azwar, 2010, p.163).

Table 2. Categories of validity and practicality of Products

Score interval	Categories
$(M + 1{,}50s) < \bar{x}$	A
$(M + 0{,}50s) < \bar{x} \leq (M + 1{,}50s)$	B
$(M - 0{,}50s) < \bar{x} \leq (M + 0{,}50s)$	C
$(M - 1{,}50s) < \bar{x} \leq (M - 0{,}50s)$	D
$\bar{x} \leq (M - 1{,}50s)$	E

Keterangan:

$\bar{x}$ = mean score

M =meanscore ideal

$= \frac{1}{2}$ (maximum score + minimum score)

S = standard deviationideal

$= \frac{1}{6}$ (maximum score – minimum score)

Learning kit as valid for use in the trial if the validity of the scores of each learning device having at least a valid category (B). Thus, the results of the analysis of data that do not meet the minimum valid category in this study will be considered to revise the learning device before tested.

While the practicality of the analysis, the study said practical if the score obtained from the questionnaire assessment of learners and teachers and observation sheets feasibility study has practical minimum category (B).

Effectiveness analysis was conducted to determine whether the device is prepared to comply with the learning effectiveness category, which is able to improve the achievement of basic competence, and are able to develop learners HOTS minimum B, through experimentation.

In the experiments conducted, there are some calculations to measure the effectiveness of learning tools are developed, starting from the assumption test analysis, normality test, homogeneity test, test the effectiveness of the learning of each class, and the latter assumption test the effectiveness of learning. Test the effectiveness of this learning assumption can only be done after all the testing analysis assumptions are met.

Test assumptions of analysis is a series of tests conducted prior to test the assumption that the learning effectiveness of the developed device. Test assumptions include normality test, homogeneity, and test the effectiveness of each class learning trials. This test using statistical software SPSS version 22.

Research Findings and Discussions

The results of the development of learning kit such as geometry flat side to improve HOTS include syllabus, lesson plans and worksheets are valid, practical, and effective, as well as the instruments are valid and reliable evaluation. The design of each of the products developed are described in the following description.

Validation is done by two expert material. At the beginning of the product validation process, the validator to provide input and assessment of learning tools are developed. Validator provide an assessment of the learning device by using the validation sheet which has been validated previously. The results of the validation study by experts material is presented in Table 3 below.

Tabel 3. Score of Validation Result for Learning Kit

Validator	Product score which was validated			
	Syllabus	Lesson plan	Student's worksheet	Evaluation instrument
1	90	152	66	228
2	95	150	76	223
Sum	185	302	142	451
Chategory	Valid	Valid	Valid	Very Valid

Estimation of reliability conducted on an evaluation instrument developed. This estimation is done by performing a test using the evaluation instrument to the ninth grade at each school where the study took place. Based on the results obtained, the coefficient alpha

for pretest multiple choice questions was 0.79, while the post-test multiple choice questions amounted to 0.78, and in the form of a description about the HOTS obtained an alpha coefficient of 0.78.

Maximum score results of the assessment of learning by teachers as a whole is 810. Based on 6 ratings teachers obtained a total score of 675 so that the assessment is developed learning tools are included in the category of very practical. The results of the analysis of teacher assessment data for learning devices developed, including syllabi, lesson plans, worksheets, and evaluation instruments, in more detail can be seen in Table 4 below.

Table 4. Results of Data Analysis Teacher Assessment Questionnaire

Teachers	Product score which was validated			
	Syllabus	Lesson plan	Student's worksheet	Evaluation instrument
1	32	31	34	24
2	30	28	30	22
3	30	29	31	23
4	32	28	30	22
5	28	26	26	18
6	32	32	34	23
Total	184	174	185	132
Chategory	Very practical	Very practical	Very practical	Very practical

Based on teacher ratings in Table 4 concluded that all the learning tools that include syllabi, lesson plans, worksheets, and evaluation instruments fall into the category of very practical, so that the learning device is said to be practically developed.

Analysis of student assessment data is accomplished by converting the data from the quantitative scores obtained into qualitative data. Assessment of learners in the form of a questionnaire distributed to 12 students consisting of learners men and women by category of high, medium, and low in each school. The results of the analysis of the developed learning obtained an average score as in Table 5 below.

Table 5. Results of Data Analysis Questionnaire Assessment Learners

Learning kit	Score	Chategory
Student's worksheet	255	Very practical
Evaluation instrument	101	Very practical

In more detail, LKS said to be very practical if the scores obtained exceeds 240, while the evaluation instrument said to be very practical if the score exceeds 96. Based on the results obtained learner assessment concluded that the learning device consisting of LKS and evaluation instruments fall into the category of very practical.

Analysis of practicality also be done by converting the quantitative data from the score sheet observations obtained feasibility study into qualitative data. Percentage results of these observations can be seen in Table 6 below.

Table 6. Observations of Learning

Meeting	SMP Negeri 1 Daha Utara	SMP Negeri 2 Daha Utara
1	42,86	57,14
2	42,86	57,14
3	71,43	71,43
4	71,43	71,43
5	71,43	85,71
6	71,43	100,00
7	100,00	100,00
8	100,00	100,00
Mean	71,43	80,36
Chategory	Very practical	Very practical

From Table 6 shows that the feasibility of learning using learning tools developed in the experimental class in Junior High School 1 North Daha are in the category of practical, sedangkana the experimental class in Junior High School 2 North Daha are in the category of very practical. From the results it can be concluded that the developed learning device meets practicality category.

Analysis of the effectiveness of learning in this study viewed from two aspects, namely the test results HOTS aspects of learning and learners.

Test for normality using the Shapiro-Wilk test for many students of each class of less than 30 people, and the homogeneity test using independent samples t test. Data were analyzed as a prerequisite of this is data pretest experimental class and control class from each school. This test using statistical software SPSS 22. Results of normality test pretest can be seen in Table 7 below.

Table 7. Results of Normality Test for Pretest

		df	Significance
SMP Negeri 1 Daha Utara	Experiment class	22	0,620
	Control class	23	0,688
SMP Negeri 2 Daha Utara	Experiment class	15	0,412
	Control class	13	0,643

From Table 7 shows that the significance value of the Shapiro-Wilk normality test in fourth grade more than the value of alpha ($\alpha = 0.05$) so that it can be concluded that the value of the fourth grade pretest the normal distribution. Furthermore, the homogeneity test results can be seen in Table 8 below.

Table 8. Summary Result of Homogenity Test for Pretest

		F Levene
SMP Negeri 1 Daha Utara	Score	0,000
	Significance	0,994
SMP Negeri 2 Daha Utara	Score	1,677
	Significance	0,207

Prior to test the effectiveness of the learning assumptions, which will be measured post-test scores should be normally distributed population. Normality test is also using the Shapiro-Wilk test. Following is a summary of the SPSS output for each class normality test post-test for each school.

Table 9. Summary Result of Normality Test for Postest

		df	Significance
SMP Negeri 1 Daha Utara	Experiment class	22	0,057
	Control class	23	0,157
SMP Negeri 2 Daha Utara	Experiment class	15	0,224
	Control class	13	0,174

From the table above shows that the significance of the Shapiro-Wilk normality test on the four classes of more than alpha ($\alpha = 0.05$) so that it can be concluded that the population is normally distributed.

From Table 10 shows Levene F test of significance of less than 0.05 (α value) for SMP Negeri 1 North Daha and more than 0.05 for 2 Daha North Junior High School, so it can be concluded that the post-test scores between the experimental class and the control class in junior high school School 1 North Daha not homogeneous, and the North junior High School 2 Daha homogeneous

Table 10. Summary Result of Homogenity Test for Postest

		F Levene
SMP Negeri 1 Daha Utara	Score	5,355
	Significance	0,026
SMP Negeri 2 Daha Utara	Score	0,013
	Significance	0,911

The last step before making the assumption test the effectiveness of learning is to test the effectiveness of each class of learning research. This assay uses paired samples t test, because the comparison is a correlation between the rise and the data pretest posttest data for each class. The following results were obtained.

Table 11. Summary Result of Paired-Sample t Test

		Experiment class		Control class	
		Correlation	t	Correlation	t
SMP Negeri 1 Daha Utara	Score	0,682	10,487	0,867	11,333
	Significance	0,000	0,000	0,000	0,000
SMP Negeri 2 Daha Utara	Score	0,564	11,145	0,737	11,628
	Significance	0,028	0,000	0,004	0,000

From Table 11 shows that the value of the fourth-class correlation was positive and significant correlation of the four classes is less than alpha ($\alpha = 0.05$) that qualifies for the paired t test. Furthermore, from signfikansi t seen that the fourth class has significance not less than alpha ($\alpha = 0.05$) so that it can be concluded that the teaching of the four classes effectively.

After all testing requirements analysis in the experimental class and control class at each school are met, then it can continue to test the assumption that the learning effectiveness of the developed device. This test aims to compare the post-test between the experimental class and the control class to find out which one is superior class after class of experimental treatments imposed. The treatment in question is the use of learning tools are developed. Data results of statistical tests on the posttest values are summarized in Table 12 below.

Table 12. Summary Result of Homogenity Test for Postest

		t
SMP Negeri 1 Daha Utara	Score	2,564
	Significance	0,014
SMP Negeri 2 Daha Utara	Score	3,309
	Significance	0,003

In addition to the views from the achievement of competence of learners through multiple choice questions, the effectiveness of the learning device is also seen from the aspect HOTS achievement of learners. Scores of matter in the form of quantitative description of converted into qualitative. Learners are said to have HOTS category B if the scores obtained are in the range $58.33 < X \leq 75,00$. In summary, the overall scores for the learners HOTS aspect of the answer to the problem description of the learners are presented in Table 13 below.

Table 13. Achievement for HOTS Aspect of Students

School	class	Total of Students Who Have Good HOTS		Total of Students	Percentage of Students Who Have Minimal HOTS B at posttest (%)
		Pretest	Postest		
SMPN 1 Daha Utara	Experiment	0	20	22	90,91
	Control	0	2	23	8,69
SMPN 2 Daha Utara	Experiment	0	13	15	86,67
	Control	0	0	13	0,00

From Table 13 it can be concluded that overall, the experimental class was better than control classes for each school. It can be concluded that the developed learning tools are effective in improving learners HOTS.

Conclusions and Suggestions

The conclusion of this study is the result of the development of learning geometry in the form of the flat side consists of syllabi, lesson plans, and worksheets valid, practical, and effective, as well as an evaluation instrument that is valid and reliable for use. Aspects of the validity of the study in terms of the assessment of the experts and achieve a valid category. Practicality of achieving practical aspects of categories in terms of adherence to the observation of learning, teacher assessment, and the assessment of learners. Aspects of effectiveness has been achieved in terms of competence and achievement of learners HOTS. The results of field trials showed that the experimental class is better than the control class views of the achievement of competence, and HOTS students in the experimental class achieve minimum category B.

Some suggestions can be put forward in this study is that the learning device is fit for use by junior high school teachers, especially in mathematics learning in class VIII in the wake of competence flat side room, and the device can be used as an example of learning by junior high school math teachers who want to develop on other competencies as well as other subjects of learning activities that can be designed with a focus on improving the learners HOTS.

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