



Development of Project Assessment Instruments to Assess Mathematical Problem Solving Skills on A Project-Based Learning

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Abstract

Assessment of the results of the study were not able to use the technique only tests the need for an assessment that can assess the 3 aspects of cognitive, affective and namely psychomotor assessment authentic like i.e. assessment of the project. Troubleshooting is the ability that must be mastered in maths learning then perlua the existence of an appropriate assessment that can assess the mathematical problem solving skills. This research aims to develop assessment instrument project to assess mathematical solving skills on a project-based learning that is valid, reliability and practical use. The type of research used in this research is the research development (research and development) with the model of the development of nontes. The subject of a trial that is grade VIII SMP Negeri Semarang 40. The data in the research gained from the results of the test of the validity, reliability and practicality. The research results showed that the assessment instrument project to assess mathematical problem solving skills on a project-based learning is declared invalid based on the input of experts and of the results obtained from the calculation of the ICC retrieved $r_{xx} > 0,814$ reliability, validity of the results invalid constructs on a small scale have the goodness of fit index $0,942 > 0.90$ and massive scale have index goodness of fit $0.935 > 0.90$ reliability then both showed $0,848 > 0.7$ on a small scale and $0867 > 0.7$ on a massive scale, as well as meet the criteria of the practical meaning of the instrument indicates the assessment of the project to assess mathematical problem solving skills in project based-learning that have been developed in valid, reliabil and practical use as well as proven to be used to assess mathematical problem solving skills of students of JUNIOR HIGH SCHOOL. This research is expected to be later exploited and used as a reference in the learning of mathematics.

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INTRODUCTION

Assessment (just my assesment) is an attempt to collect data or information by using the multiteknik and multisumber were used as the basis for decision making (Wiyono Sunarni and 2009:3). The assessment shall be carried out in accordance with the objectives of the assessment to be achieved in a given study. The purpose of the valuation (assessment) is to know the level of learning objectives ketercapaian and see the effectiveness of teaching and learning (Rashid, 2007:26) has a broad scope of Assessment ranging from compulsory or optional activities/tasks for students in learning and the suitability of certain forms of assessment service is influenced by considerations of disciplines and types of learning that is recorded (Zacharis, 2010:61).

Sa'ud (2008:172) States that the assessment service is the process of collecting a variety of data results that could give an overview of the development of student learning. The assessment is to take a decision, with reference to a certain size like good and bad, clever or stupid, high or low and so forth (Supardi 2015:11).

Implement (assessment) and the results of learning process is an activity of teachers over the span of learning related to decision making about the achievement of competence of students who have individual characteristics which are unique (Department of national education: 2006).

Assessment or assessment in learning that do certainly have the goal to be achieved Balitbang Mone (2006:3), stated that the purpose in detail assessment of the process and the results of the study are to:

1. Find out the level of achievement of the competencies during and after the learning process takes place.
2. Provide feedback to students in order to know the strengths and weaknesses in the process of achevement of competence.
3. Monitor the progress and diagnose learning difficulties experienced by students so that they can do enrichment and remedial.

4. Feedback for teachers in methods, approaches, activities, and learning resources are used.
5. Provide alternative options to the teacher asesment.
6. Provide information to parents and school Committee about the effectiveness of education.

Assessment methods with test engineering can not analyze the skills of students as mathematical problem solving skills of students. One form of assessment emphasizes the third competency through an assessment that operates on a learning process rather than on the results of the assessment are authentic (Nurjananto and Kusumo,2015). Authentic assessment is not only viewed and mengvaluasi students in just one realm but will include three domains, namely cognitive, affective and psychomotor.

Authentic assessment as activity assessing learners who put emphasis on what it should be judged, both process as well as the results of the assessment with various instruments adapted to the demands of competence (Kunandar,2013). The aim is also to provide authentic penilian assessment holistically in various ways either by assessment of performance, assessment of the products and the assessment of the project.

Assessment project (project just my assesment) is one of the authentic forms of assessment that could be used in the assessment of learning. The assessment of the project is the assessment of the activity of a task to be completed in a certain period of time. The task in the form of an investigation from the planning, data gathering, organizing, processing and presenting data (Moh. Sahlan, 2007:99). Project task is a task that must be completed within a certain period of time students (Wahyuni and Ibrahim, 2012).

The task in the form of a ivestigasi from the gathering, organizing, pengevaluasi to present the data. In this project students have the opportunity to apply ketrampilannnya. Marhaeni (2007) also stated that the assessment of the project is an in-depth investigation on a topic is real, where students have the opportunity to apply his skills. The assessment of the project is the assessment of

the activity of a task to be completed in a specific time period or (Hosnan, 2014:404). The assessment of the project according to the Arikunto (2013) is an assessment of the activities of an investigative process for a meaningful benefit was found for human life which must be completed within a certain period of time.

The assessment of the project focuses on the planning, workmanship, and products of the project. In addition, the assessment of the project also has some advantages such as: (1) increasing the motivation of student learning to learn; (2) improve the problem solving skills of students; (3) making students become more active and successfully solve complex problems; (4) encourage students to develop and practise the skill of communicating; (5) providing learning and practice experience to students in organizing project (Daryanto, 2014:26). In accordance with the purpose and advantages of the assessment of the project need to be used in the learning process of learning.

The assessment of the project can be used in a variety of majors in one field of study mathematics. The study of mathematics is a field of study that are useful and help in solving various problems in everyday life that relate to calculate calculating or otherwise relating to the Affairs of the figures of various kinds of problems, which require a skill and ability to break it. Therefore, students as one of the components in education should always be trained and conditioned to think independently to solve problems (Susanto, 2013:195).

Mathematical problem solving ability is one of the skills that need to be controlled because students through problem-solving activities, aspects of the important math skills such as application of the rule at issue is not routine, the discovery of patterns and others, can be developed better (Suherman, 2003:89).

This workaround is a complex process requiring a person to coordinate the experience, knowledge, understanding, and intuition in order to meet the demands of a situation. While the process of problem solving is the work of solving the problem, in this case the process of accepting

a challenge that requires hard work to solve the problem (kurniawan, 2016).

NCTM (2000:7) stated that one of the goals of learning math is to develop mathematical problem solving ability. A resolution in this regard (McGivney and DeFranco, 1995) includes two aspects, namely, the problem of finding (problem to find) and the problem of proving (problem to prove).

Another important component in learning mathematics is the use of the learning model. Use of the varied and interesting learning can support the learning objectives ketercapaian. One of the learning models that are appropriate for the learning of mathematics is project based learning. Project based learning is learning through specific projects that must be completed by students. Projects are given tasks that teachers based on challenging questions or issues, engaging students in design, problem solving, decision, or investigating activities, grant in autonomy for the time period for collecting and integrating new knowledge based on the experiences of students in a real (Yunianta, Rochmad & Rusilowati, 2012).

Project Based Learning (PBL) is a model or innovative approach to learning, which emphasizes the contextual learning through complex activities (Purnomo & Mawarsari, 2014). The focus lies in learning the concepts and the core principles of a discipline of study, involving students in problem solving and investigative activities in other meaningful tasks, giving the opportunity students work autonomously construct their own knowledge, and reached its peak produces a real product (Karina, Sadia, & Suastra, 2014).

Project-based learning is an effective educational approach that focuses on the creativity of thinking, problem solving, and the interaction between the learners with their peers to create and use new knowledge. (Ibn Al-Badr Trianto tabany: 2014). This may underlie the project based learning that can be used to direct the students get used to train mathematical problem solving skills.

METHOD

The type of research used in this research is research or research and development commonly referred to with research development. Research and development is a research method that is used to produce a particular product, and test the effectiveness of the product (Sugiyono 2010:407). R&D emphasizes product that is useful or helpful in various forms as the expansion, enhancements, and innovations from forms already existing (son, 2012:70)

The products referred to in this research is the project assessment instruments to assess mathematical problem solving skills in project based learning.

The subject of research is the grade VIII semester even 40 Semarang State Junior High School lesson 2017/2018 and Junior High School teachers of mathematics State 40. Subject tests are done on a small scale instrument grade VIII. While the testing done on a wide scale instrument grade VIII. In the meantime, subject to the analysis of the needs of the development of test instruments and practicality are the teachers of mathematics teaching in Junior High School the country 40 Semarang as much as 4 people. In April-May 2018 subject tests selected randomly and divided into 2 IE test subjects small and large scale trials.

Development of project assessment instruments to assess the ability of JUNIOR HIGH SCHOOL students ' problem-solving research procedure designed using the steps in the Mardapi pass (2008). Ten steps that need to be reached in the development of instruments, namely: (1) determine the Specifications instruments; (2) writing instruments; (3) menetukanskala instruments; (4) determine the scoring system; (5) review instruments; (6) affect a trial; (7) analyse the instruments; (8) assemble the instruments; (9) carry out measurement; (10) to interpret the measurement results.

RESULTS AND DISCUSSION

This research resulted in the project assessment instruments to assess mathematical problem solving skills in students of Junior High School with 14 rounds shared instruments in the preparation, execution and reporting and is declared invalid based on input from experts as well as in test aiken V with V index average of $0.82 > 0.3$ so that project assessment instrument is declared valid.

The validity of the content that is being estimated is passing the test viability or relevance of test content through rational analysis by panels of competent or through expert judgement (Saifudin,2012).

Following are the results of the test of the validity of the content based on the consideration of experts for the assessment of the project can be seen in table 1

Table 1. assessment of the instruments of Project Assessment based on Grains

Grain numbers	Koefisien Aiken's V	Description
1-14	0.67 -1.00	Feasibility

In table 1, each instrument acquired grain V index is greater than the critical r 0.3 so that the results of the expert conclusion 3 declared fit after some decent revised in accordance with advice and input from experts.

After getting the results of conclusions of the feasibility of an instrument from the experts, the next step is to calculate the rate of agreement (reliability) of the third intergovernmental experts. Reliability or reliability is a coefficient that shows the level of keajekan or the consistency of the measurement results of a test (Djemhari mardapi, 2016).

Level of agreement (reliability) between the third validator can be explained by calculating the coefficient of reliability between rater or appraisers using the Intraclass correlation analysis's (ICC) with the help of the program.

According to Suharsimi (2008:75), the assessment instruments can be said reliabil when $r_{xx} > 0.6$. The results obtained from the calculation of the ICC obtained reliability $r_{xx} > 0,814$, so it can be stated that the instrument of project assessment reliabil and ready to do a test run.

Sample test on a small scale by as much as 35 respondents grade VIII. On a small scale test to test the validity of the contract and the contractual instrument reliability. The validity of the kontrak is types of validity of quantitative empirical field data based. The figures give statistical info about the validity of this. (Jelpa periantalo, 2015).

Test the validity of Confirmatory factor analysis is used with the (CFA) using lisrel software 9.30, showed the value of a T value significance no less than 1.96 > may imply that all grain on each each valid indicators and significant can measure assessment project. This indicates that the structural instruments of the conceptual model assessment project that developed is appropriate.

The criteria used in determining the kontruk to form a model is 0.5 and CFI RMSEA <, NFI, GFI and also NNFI should be more than 0.90.

Those results can be presented in table 2.

Table 2. Output Results Criteria Goodnes Of Fit

Latent variables	Test	the terms of the	The value	Description
P1	RMSE	< 0.05	0.00	Good fit
P2	A		0	
p3	RMR	< 0.05	0.04	Good fit
	CFI	> 0.90	1.00	Good fit
	NFI	> 0.90	0.90	Good fit
	AGNI	≥ 0.90	0.91	Good fit
	NNFI	≥ 0.90	2.49	Good fit

GFI	> 0.90	0.94	Good fit
2			
Decision		Good fit	

The results of the analysis of goodness of fit look kontruk used that already form a model of assessment of the project factors analysis on the process of konfirmatori it already meets the criteria of a good fit. The value of probability testing goodnes of fit showed RMSEA 0.00 (0.05), RMR 0.044 (<0.05), CFI 1,000 (>0.90), NFI 0,901 (0.90), AGNI 0918 (min 0.90), NNFI 2,490 (Min 0.90) and GFI 0.942 (> 0.90) meet the criteria for testing goodness of fit.

Sample test on a large scale as much as 100 respondents grade VIII analysis results that the path variable is a significant donation of paint against the latent variable because the value of<0.05), T value significance no less than 1.96 > may imply that all grain on each each valid indicators and significantly can measure assessment project. This indicates that the structural instruments of the conceptual model assessment project that developed is appropriate.

The criteria used in determining the kontruk to form a model is 0.5 and CFI RMSEA <, NFI, GFI and also NNFI should be more than 0.90. Those results can be presented in table 3.

Table 3. results Output Criteria Goodnes Of Fit

Latent variables	Test	The value	Description
P1	RMSEA	< 0.05	0.00
P2	RMR	< 0.05	0.040
P3	CFI	> 0.90	0.902
	NFI	> 0.90	0.880
	AGNI	≥ 0.90	0.920
	NNFI	≥ 0.90	1.365
	GFI	> 0.90	0.935
Decision		Good fit	

Analysis test conducted on a small scale and the large scale and both were declared fit goot so it can be inferred that the project assessment instrument was declared good fit, after fit good on test revealed a small scale and large scale trials

later in the Test reliability invalid constructs used to indicate that the instrument can provide results that are relatively the same when measurements are performed on the same object. The value of the reliability of the recommended kontruk > is 0.70 Ghozali (2008:79).

Construct of reliability assessment instruments 0.848 > 0.7 indicates project on a small scale and showed 0.867 > 0.7 on a large scale can thus be inferred that the reliability assessment instruments are invalid constructs and variants project to assess skills mathematical problem solving have been met.

Data results anget response against teacher assessment instruments practicality projects can be presented in the following table.

Table 4. Data analysis results Now Practicality Assessment Instruments

Rater	Mean	Criteria
1	0.7	Praktis
2	0.72	Praktis
3	0.70	Praktis
4	0.76	Praktis
5	0.72	Praktis

The calculation results show the response of teachers towards practicality assessment instruments project at the show in the table, as well as information obtained that the assessment instrument for all aspects of project has the lowest i.e. practicality score 35 and the highest is 38 out of 5 respondents teacher. Based on the criteria made by the researchers, the conclusion that each expert assess the project assessment instruments to assess the problem solving skills of students of Junior High School is a practical use.

CONCLUSION

This research project assessment instruments to assess mathematical problem solving skills in students of Junior High School with 14 rounds shared instruments in the preparation, execution and reporting and is declared invalid on the basis of input from experts as well as in test aiken V with V index average of 0.82 > 0.3 so that project assessment instrument

is declared valid, the criteria (reliability) deal experts 0.814 > 0.6 so that it can be stated that the instrument of project assessment reliabil.

The validity of konstrak with path analysis using lisrel test on a small scale or large scale testing both indicate that each factor contributed significantly to the variable since all paths > 0.4. Analysis of the value of T diliahat with standard model indicates that the calculation of the estimsi component of project assessment instruments significant kontruk because $T_{hitung} > 1.96$.

The results of the evaluasi goodness of fit invalid constructs that are used to form the assembled model evaluation project on the process of confirmatory factor analysis with lisrel already meets the criteria for goodness of fit has set well on small scale test and test scale large. Construct of reliability assessment instruments 0.848 > 0.7 indicates project on a small scale and showed 0.867 > 0.7 on a large scale can thus be inferred that the reliability assessment instruments are invalid constructs and variants project to assess skills mathematical problem solving have been met.

An assessment of the practicability of the instruments are rated based on 5 subjektifitas, i.e. indicators, systematic construction, language and practicality. The results of the assessment that the project evaluation instrument for all aspects has score highest and lowest practicality 35 38 of 5 respondents teacher. Based on the criteria defined by the researchers, obtained the results that each of the respondents rate the project evaluation instrument has been developed by researchers is practical for later use.

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REFERENCES

- Azwar, saifudin. 2012. *Reliability and validity*. Yogyakarta: Pustaka Pelajar

- Al tabany, trianto Ibn Badr. 2014. *Designing innovative learning Model, progressive, and contextual*. Jakarta: Prenadamedia Group.
- Daryanto. 2014. *The approach to Scientific Learning curriculum is 2013*. Yogyakarta: Media Gava
- Desnylasari, e., Mulyani, s., & Mulyani, b. (2016). The Influence Of Model Learning Project Based Learning And Problem Based Learning On The Learning Achievements Against Thermo Material Grade Xi Year Of Lessons. *Journal of chemical education*, 5 (1), 134 – 142.
- Depdiknas. 2006. *The curriculum unit level education*. Jakarta: Ministry of national education
- Hosnan, m. 2014. Scientific approaches and contextual Learning in the 21st century. Bogor. Ghalia Indonesia Publisher.
- Karina, n. k. d., Sadia, i. w., & Suastra, i. w. (2014). Influence Of Project-Based Learning Model Of Self Efficacy. *E-Journal graduate school of Education University of Ganesha*, 4 (2).
- Kunandar. 2014. *Authentic Assessment (assessment of Learning Outcomes Learner Curriculum based on 2013)*. Depok: Rajagrafindo Persada.
- Kurniawan, y. (2016). Improvement Of Mathematical Problem Solving Ability Of Junior High School Students Through A Contextual Approach To Learning. *Journal of educational research And teaching mathematics*, 2 (1), 75 – 86.
- Mardapi, Djemari. 2016. *Measurement and evaluation of educational assessment*. Yogyakarta: Parama
- Marhaeni Publising, AAIN. 2007. Learning innovative and Authentic Assessment in order to create an effective and productive Learning.
- NCTM. (2000). Principles and standards for school mathematics. Reston, VA: The National Council of TeacPhers of Mathematics, Inc.
- Periantalo, Jelpa. 2015. *The validity of the measuring instrument Psychology:practical applications*. Yogyakarta: Pustaka Pelajar
- Purnomo, e. a., & Mawarsari, v. d. (2014). Increased Ability Of Problem Solving Through Learning Model Ideal Problem Solving-Based Project Based Learning. *Jkpm*, 1 (1), 24 – 31.
- Son, n. 2012. *Research & development research and development: An introduction*. Jakarta: Eagle Press
- Rashid, Harun and Mansur. 2007. *Assessment of the results of the study*. Bandung: Cv. Prima Discourse.
- Sahlan, m. 2007. *Class-Based Assessment*. Jember: Jaya Makmur Offse
- Suherman, e. 2003. *Konteporer Mathematics Learning Strategies. Rev. ed*. Bandung: UPI
- Susanto. 2013. The understanding of the Students in problem solving of proof On concept of Group based on Cognitive Style. *Education and learning journal* 20 (2)
- Sugiyono, a. 2010. *Educational Research methods: qualitative and quantitative approaches*, Bandung: alfabeta R&D.
- Supardi. (2015). *authentic assessment of the learning of Affective, cognitive and Psychomotor (concepts and applications (1st ed.)*. Jakarta: PT Rajagrafindo Persada.
- Zacharis, N.T. 2010. Innovative Assessment for Learning Enhancement: Issues and Practices. Contemporary Issues in Education Research