

Implementation of the Authentic Assessment Model in Problem-Solving Learning: Cases in Early Childhood Education

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Abstract: An assessment instrument is one of the most important factors to guarantee objectivity, fairness, and accuracy in assessing the level of students' performances in the learning process. This study aims to produce an authentic assessment model on problem solving learning at early childhood education. The objectives of this study are to examine the feasibility of the developed authentic assessment model in the aspects of practicality, effectiveness, and its accuracy. This study was a research and development that adopts the ADDIE development model. The research subjects consisted of eight teachers and 44 students selected with a purposive sampling technique. The data were collected using questionnaires and observation sheets. Its data were analyzed with inter-rater reliability, inter-item correlation, and intra-class correlation. The results of the study show that the developed authentic assessment model on problem solving learning was feasible to be implemented at early childhood education.

Keywords: Early childhood education, authentic assessment, problem-solving

1. Introduction

An assessment instrument is one of the most important factors to guarantee objectivity, fairness, and accuracy in assessing the level of students' performances in the learning process. Based on the findings in the field, the assessment instruments used to assess the development of students on problem solving learning at early childhood education at present are not structured and detailed, unoperational, unpractical to use, and have never been standardized to see validity and reliability. As a result, it was found that the results of the assessment on problem solving learning by two teachers at early childhood education were incorrect, or the results were different. Therefore it is very important to develop an authentic assessment model on problem solving learning at early childhood education, so that the assessment of student learning outcomes carried out by teachers can be accurate.

Problem solving is very crucial for the growth and development of students at early childhood education to be creative and innovative individuals who have competitiveness in a wider scope. Problem solving learning is one of the High Order Thinking Skills (HOTS) learning, which is popular as 21st century learning. Thinking and solving problems cannot be separated in the learning process. The ability to solve problems is the main key in understanding naturally while the ability to solve problems is obtained by direct practice and approaches used to understand problems [1].

This problem-solving learning method is often referred as experimental methods, reflective thinking methods, or scientific methods [2]. The problem-solving method is a way of presenting lessons by encouraging students to search for and to solve a problem in achieving teaching goals [3]. Therefore the teacher is required to be able to manage the class well and can use various teaching styles in accordance with the presented materials [4]. The problem solving learning methods are very potential to train students to think creatively in dealing with various personal problems and group problems to be solved alone or together [5].

Based on the various opinions mentioned above, it can be concluded that problem solving learning is learning that uses real life (authentic) open-ended problems to be solved by students to develop thinking skills, problem solving skills, social skills for independent learning and building or acquiring new knowledge.

Ideal learning must be able to provide opportunities for students to build their own knowledge through interaction with parents, siblings, teachers, friends, and the environment. Learning activities must be in accordance with the principles that include: (1) fun, (2) oriented to students' development, (3) oriented to students' needs, (4) active learning, (5) oriented to the development of character values, (6) oriented to life skills development, (7) conducive environment, (8) oriented to democratic learning, and (9) the use of media and learning resources [6].

According to the 2013 curriculum in Indonesia, the problem-solving learning model is one of the learning models that must be mastered by teachers at early childhood education. The learning approach used in the problem-based learning model is a scientific approach that consists of five steps of learning activities,

namely: observing, asking questions, collecting data, associating, and communicating.

Assessment instrument is one of the most important factors to guarantee objectivity and fairness in assessing students' ability levels. Therefore, accurate instruments are required in each assessment activity. The assessment instrument is considered to be good if it meets several criteria, namely (1) relevant in data collection in accordance with the purpose of the assessment, (2) there is balance of proportions of measurement multi dimensionally, (3) it can be used efficiently, (4) objectivity in scoring, (5) consistency of measurement, (6) describing honesty (not biased), (7) specifically measuring aspects being studied, (8) describing the level of difficulty addressed by the skills, knowledge, and abilities of individual ability levels, and (10) do not measure individuals' speed [6]. Assessment is a process carried out to measure the achievement of students' competencies on an ongoing basis in the learning process, to monitor progress and improve students' learning outcomes, and plan further learning activities [7].

Authentic assessment is a process of gathering significant information on students' learning outcomes in the aspects of attitudes, knowledge, and skills by the teacher by using various measurement techniques based on actual facts. It is further stated that authentic assessment is a form of assessment, in which students are asked to perform real-world assignments that demonstrate the application of the knowledge and skills they have learned [8],[9]. Authentic assessment is a form of evaluation to describe the real knowledge and skills of the students as a result of learning activities. authentic assessment can be conducted using several techniques, such as product assessment, project assessment, portfolio assessment, self-assessment, peer assessment, written examinations, journals, and observations [10].

Authentic assessment has strong relevance to scientific approaches in learning that are in accordance with the 2013 curriculum in Indonesia. Authentic assessments are able to describe improvement in student learning outcomes through a scientific approach, namely observing, asking, gathering information, associating, and communicating. Authentic assessment is also able to show students' abilities, provide feedback and direction for their growth and development [11]. Authentic assessment contributes to the development of self-concept and achievement motivation and attitudes, and students' self-confidence [12], [13]. Authentic assessment is able to develop student motivation and achievement in learning [14]. Furthermore, authentic assessment integrates continuous learning activities, and can enhance abilities and critical and creative thinking [15]. According to Gulikers et al. (200) authentic assessment requires students to use and demonstrate competence, or a combination of knowledge, skills and attitudes that can be applied in real life. In authentic assessments, students are asked to do assignments in real-world regulatory questions as applications of knowledge and skills acquired [8]. Authentic assessment is focused on giving assignments to students as actualization of their knowledge and skills because they will be applied in the real world. This is in accordance with the opinion of Burton who stated that authentic assessment is directly related to real work practices [16]. There are several reasons for using authentic assessment in learning: (1) it can produce direct measurements, (2) learning, and (3) it can integrate assessment and teaching [17]. Authentic assessment is not only seen from the results of the task (product), but also from the quality of the educational process that involves students to be more human [18].

Based on the various opinions mentioned above, it can be concluded that the authentic assessment model on problem solving learning at early childhood education must contain the form of problem-solving activities, time allocation, observation sheet evaluation, description of problem-solving abilities, and criteria in problem solving

Based on the findings in the field, the assessment instruments used to assess the development of students in problem solving learning at early childhood education at present are not structured and detailed, they are not operational, not practical to use, and have never been standardized to see their validity and reliability. As a result, it was found that the results of the assessment in problem solving learning by two teachers at early childhood education were incorrect, or the results were different. Therefore it is very important to develop an authentic assessment model in problem solving learning at early childhood education, so that the assessment of student learning outcomes carried out by teachers can be accurate.

2. Method

2.1. Research Design

This study is categorized as research and development that adopts a model from Brach [19]. This development model consists of five steps namely: Analyze, Design, Develop, Implement, and Evaluate (ADDIE). Authentic assessment developed on problem solving learning consists of four components of students' abilities, namely: (1) understanding problems, (2) planning solutions, (3) implementing solutions, and (4) evaluating solutions.

2.2. Participants

The research subjects consisted of 8 teachers and 44 students selected with purposive sampling technique. It was conducted at four early childhood educations in Yogyakarta. Experts in early childhood learning and assessment are invited to provide the validation the instrument of research.

2.3. Instruments

Data collection techniques used questionnaires and observation sheets. Questionnaires were used for data collection in the aspects of practicality and effectiveness while the observation sheet is used for data collection in the aspects of the implementation of the assessment process on problem solving learning at early childhood education. The outline of the research instrument is listed in Table 1.

Table 1: Instrument grid for assessing practicality, effectiveness, and implementation of the assessment process on problem solving learning

No.	Aspect	Indicator
A. Practicality of the Authentic Assessment Model		
1.	Application	1. Ease in using the valuation model 2. The simplicity of the assessment model format 3. Clarity of stages of problem solving 4. Clarity of authentic assessment characteristics 5. Clarity of score and criteria in data tabulation
2.	Language	1. Standard and communicative language 2. Use of terms that are easy to understand
B. Effectiveness of the Authentic Assessment Model		
1.	Stages of Problem Solving	1. Demands for problem solving steps 2. Conformity with Basic Competencies 3. Conformity with problem solving cases / activities
2.	Characteristics of Authentic Assessment	1. Representation of authentic assessment characteristics with cases / problems 2. Conformity of authentic assessment characteristics 3. Representation of authentic assessment characteristics to describe students' ability to solve cases / activities
3.	Case for Problem Solving	1. Learning activities are displayed in the form of cases / problems 2. Students understand learning activities from the cases / problems given 3. Completion of cases / activities using problem solving approaches 4. Suitability of cases / problems with everyday life 5. Suitability of cases / problems with Basic Competence
C. Implementation of the Assessment Process Using the Authentic Assessment Model		
1.	Preparation	1. Preparing tools, materials, and places for learning activities 2. Conditioning students to be ready to start problem solving activities 3. Prepare authentic assessment models
2.	Core activities	1. Determine the sequence of problem-solving learning 2. Determine the stages of problem-solving learning 3. Organize the activities of student activities in problem solving learning in accordance with the topic taken.
3.	Closing	1. Describe the ability of problem-solving steps in each student in problem solving learning 1. Make the problem-solving ability criteria for each student in accordance with the Guidebook

2. Closing problem solving learning activities

2.4. Data Analysis

The data analysis used to determine the feasibility of the authentic assessment model developed is the analysis of reliability inter-rater, inter-item correlation, and intra-class correlation. Whereas to determine the level of practicality, the effectiveness and implementation of the assessment process used criteria adapted from Azwar [20]. These are presented in the following Table 2.

Table 2: Criteria for practicality, effectiveness, and the implementation of authentic assessment model in early childhood education

No.	Interval	Criteria
1.	$X > X_i + 1.5 S_{bi}$	Very Good
2.	$X > X_i + 1.5 S_{bi}$	Good
3.	$X_i - 0.5 S_{bi} < X = X_i + S_{bi}$	Moderate
4.	$X_i - 1.5 S_{bi} < X = X_i - 0.5 S_{bi}$	Poor
5.	$X = X_i - 1.5 S_{bi}$	Very Poor

X = Actual total score

X_i = ideal score = $1/2$ (ideal maximum score + ideal minimum score)

S_{bi} = Standard deviation of ideal score = $1/6$ (ideal maximum score - ideal minimum score)

3. Results and Discussion

To find out the feasibility of authentic assessment models developed in terms of practicality, effectiveness, and the implementation of authentic assessment processes, a model implementation was carried out. Implementation of authentic assessment models is carried out after obtaining validation from the assessment experts. The implementation of authentic assessment models on problem solving learning was carried out in four classes with a total of 8 teachers and 44 students at early childhood education in Yogyakarta, Indonesia.

The following is a description of teacher assessment data on authentic assessment models that are developed both in terms of practicality, effectiveness, and implementation of the assessment process. Data from teacher assessment results on the practical aspects of the authentic assessment model can be seen in Table 3.

Table 3: Results of practical assessment of the authentic assessment Model

Resp.	Assessment Item Number							Score	Criteria
	1	2	3	4	5	6	7		
Teacher 1	4	3	4	4	3	4	4	26	Very Good
Teacher 2	4	3	3	3	4	3	3	23	Very Good
Teacher 3	4	4	4	3	4	3	3	25	Very Good
Teacher 4	3	4	3	3	3	3	4	23	Very Good
Teacher 5	4	3	4	3	4	3	3	24	Very Good
Teacher 6	3	3	4	3	4	2	3	22	Very Good
Teacher 7	3	3	3	3	3	2	2	23	Very Good
Teacher 8	3	3	4	3	4	3	3	23	Very Good

Total Score of Research Result (SX) = 116 189

Average Total Score of Research Results (X) = 23.62

Ideal Total Score (SXi) = $8 \times 7 \times 4 = 224$

Ideal Average (Xi) = 17.5

Standard Deviation Ideal (Sbi) = 3.5

Table 3 shows that all of the 8 teachers gave very good criteria. This means that in the aspect of practicality, the teachers in early childhood education considered the developed authentic assessment model as very good. Data description of the authentic assessment instrument model can be seen in Table 4. Based on the teacher assessment data, it can be seen that there were five teachers who gave very good ratings, and three teachers gave good ratings thus it means that in general the teachers stated that the effectiveness of the authentic assessment model that developed in early childhood education is good.

Data from teacher assessment results in the aspects of the implementation of the authentic assessment model developed is presented in Table 5. Based on the data from the teacher's assessment, it can be seen that there were five teachers who gave good ratings, and three teachers gave quite good ratings thus it means that in

general the teachers state that the level of implementation in the assessment process using this authentic developed evaluation model is already good. Data from the assessment of students' ability in problem solving learning using authentic assessment models can be seen in Table 6. It shows that students who have the ability with good and very good criteria are 81.6%.

Table 4: Summary of the authentic assessment instrument model

Resp.	Assessment Item Number												Score	Criteria
	1	2	3	4	5	6	7	8	9	10	11	12		
Teacher 1	4	3	3	3	3	3	3	3	3	3	3	4	38	Good
Teacher 2	3	4	3	4	4	3	4	4	4	3	4	4	44	Very Good
Teacher 3	4	3	3	3	3	3	3	3	3	3	2	3	36	Good
Teacher 4	4	3	3	3	3	3	3	3	3	3	3	3	37	Good
Teacher 5	4	4	4	3	4	3	3	4	4	3	3	3	42	Very Good
Teacher 6	3	3	3	4	3	3	3	3	4	3	3	3	38	Very Good
Teacher 7	4	3	4	4	3	4	3	3	3	3	3	4	41	Very Good
Teacher 8	3	4	4	4	4	3	3	4	3	4	2	3	41	Very Good

Total Score of Research Result (SX) = 317
 Average Total Score of Research Results (X) = 39.63
 Ideal Total Score (SX_i) = 8 x 12 x 4 = 384
 Ideal Average (X_i) = 30
 Standard Deviation Ideal (S_{bi}) = 6.00

Table 5: Summary of the results of evaluation of the implementation of the model

Resp.	Assessment Item Number									Score	Criteria
	1	2	3	4	5	6	7	8	9		
Teacher 1	4	3	3	3	3	3	4	3	3	27	Moderate
Teacher 2	3	4	3	3	2	4	3	3	3	28	Good
Teacher 3	3	3	3	3	2	3	4	3	3	26	Moderate
Teacher 4	3	3	3	3	2	3	3	3	3	25	Moderate
Teacher 5	3	3	4	3	3	4	3	3	4	31	Good
Teacher 6	4	3	3	3	3	4	4	3	4	29	Good
Teacher 7	3	3	4	3	3	3	3	2	3	27	Good
Teacher 8	3	3	3	4	3	3	3	3	3	28	Good

Total Score of Research Result (SX) = 221
 Average Total Score of Research Results (X) = 27.62
 Ideal Total Score (SX_i) = 8 x 9 x 4 = 288
 Ideal Average (X_i) = 40.5
 Standard Deviation Ideal (S_{bi}) = 3.5

Table 6: Frequency of student ability in learning solution to problem

Criteria	Freq.	Percentage	Valid Percentage	Cum. Percentage
1	1	2.3	2.3	2.3
2	7	15.9	15.9	18.2
3	28	63.6	63.6	81.8
4	8	18.2	18.2	100
Total	44	100	100	

The reliability of the authentic assessment model developed was analyzed based on the Cornbach's Alpha (a) value. The results of the reliability analysis of the authentic assessment model can be seen in Table 7.

Table 7: Reliability analysis of the authentic assessment model

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.967	0.980	8

Based on the reliability statistics table, it is known that the Cornbach's Alpha value of (a) = 0.967. This shows that the instruments developed in the authentic valuation model have a 'very reliable' level of reliability. This is in accordance with the criteria for the reliability level of Cornbach's Alpha according to Hair et al. (2010) presented in Table 8.

Table 8: Level of reliability

Score Cornbach's Alpha	Reliability level
0.0 - 0.20	Very Poor
> 0.20 - 0.40	Poor
>0.40 - 0.60	Moderate
>0.60 - 0.80	Good
>0.80 - 1.00	Very Good

Analysis of the level of agreement between teachers in the assessment of the model developed, using inter-item correlation and intra-class correlation coefficient. The results of the inter-item correlation analysis to determine the level of agreement among teachers can be seen in Table 9.

Table 9: Inter-Item Correlation Matrix on implementing the Assessment Model Kappa Coefficient (κ)

	Teach.1	Teach.2	Teach.3	Teach.4	Teach.5	Teach.6	Teach.7	Teach.8
Teach.1	1.000	.866	1.000	1.000	.866	.866	.866	.866
Teach.2	.866	1.000	.866	.866	1.000	1.000	1.000	1.000
Teach.3	1.000	.866	1.000	1.000	.866	.866	.866	.866
Teach.4	1.000	.866	1.000	1.000	.866	.866	.866	.866
Teach.5	.866	1.000	.866	.866	1.000	1.000	1.000	1.000
Teach.6	.866	1.000	.866	.866	1.000	1.000	1.000	1.000
Teach.7	.866	1.000	.866	.866	1.000	1.000	1.000	1.000
Teach.8	.866	1.000	.866	.866	1.000	1.000	1.000	1.000

Based on the Inter-Item Correlation Matrix table on the implementation of the valuation model, it can be seen that the value of the Kappa (κ) coefficient between all teachers is > 0.81. Thus, it means that among these teachers has a very strong level of agreement on the authentic assessment model that has been developed. This is in accordance with the agreement level criteria or the Kappa coefficient value (κ) adapted from Landis et al. in Table X. To find out the level of agreement both individually and between teachers, an intra-class correlation coefficient analysis was carried out. The results of inter-class correlation coefficient analysis can be seen in Table 9.

Table 10: Level of agreement strengths kappa coefficient value

Kappa Value	Strength of agreement
< 0.20	Poor
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81 – 1.00	Very Good

Table 11: Intra-class correlation coefficient

Intra-class Correlation ^b	95% Confidence Interval		F Test with True Value 0			
	Lower Bound	Upper Bound	Value	df1	df2	sig
Single Measures .846 ^a	.510	.996	45.267	2	14	0.000

Average Measures .976 ^c	.893	.999	45.267	2	14	0.000
Two-way mixed effects model where people effects are random and measures effects are fixed.						
a. The estimator is the same, whether the interaction effect is present or not.						
b. Type C intra-class correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.						
c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.						

Individual Kappa (κ) Coefficient Value Calculation of the assessment practicality, effectiveness, and implementation by each teacher on the authentic assessment model in developing problem solving learning has a Kappa (κ) Coefficient of 0.846. It can be said that each individual has a very strong agreement level. The calculation of the practicality, effectiveness, and implementation between teachers on the authentic assessment model in developing problem solving learning has a Kappa (κ) Coefficient of 0.976, it can be said that all teachers have a very strong agreement level.

Individual Kappa (κ) Coefficient Value Calculation of the assessment of practicality, effectiveness, and implementation by each teacher on the authentic assessment model in developing problem solving learning has a Kappa (κ) Coefficient of 0.846, it can be said that each individual has a very strong agreement level.

The calculation of the practicality, effectiveness, and implementation between teachers on the authentic assessment model in developing problem solving learning has a Kappa (κ) Coefficient of 0.976, it can be said that all teachers have a 'very strong' Individual Kappa (κ) Coefficient Value Assessment of practicality, effectiveness, and implementation of each teacher on the authentic assessment model in developing a problem solving learning has a Kappa (κ) Coefficient = 0.846, it can be said that each individual has a very strong agreement level.

The calculation of the practicality, effectiveness, and implementation of teachers on the authentic assessment model in developing a problem-solving learning has a Kappa (κ) Coefficient = 0.976, it can be said that all teachers have a very strong agreement level agreement level.

The development of authentic assessment models on problem solving learning refers to the learning of High Order Thinking Skill (HOTS), one of which is problem solving learning. Problem solving learning has many advantages for students, namely, sharpening thinking skills [21], improving skills in solving social problems [22], [23], [24], improving math skills[25], 26], improve interpersonal skills[27], [28], and have an impact on student learning achievement [19], [3], [29].

The authentic assessment model is often used by teachers for learning mathematics with various media [30]. Policy assessments in learning and curriculum are divided into three, namely assessment approaches to development, assessment approaches to development and learning, and assessment approaches to learning [31]. In this study using an assessment approach to learning.

The product quality of a development is based on three criteria. The three criteria are: validity, practically, and effectiveness [32]. A product of development is called valid if it reflects the soul of knowledge (state-of-the-art knowledge) or referred to as content validity. Meanwhile the product components must be consistent with each other (construct validity). Furthermore, a product is categorized to be practical if the teacher and other experts state that the product can be used easily by the teacher and students as users. Then a product is categorized to be effective if it gives results in accordance with the objectives set by the developer.

The product of development is called valid if the components of the material are based on state-of-the-art knowledge (content validity) and all components should be consistently linked to each other (construct validity) [10]. If the product fits these conditions, then it is regarded valid. This means that product material must be based on the area of knowledge (content validity) and all components must be consistently related to each other (construct validity). If the product meets these requirements, then it is valid. The development results are said to fulfill the content validity if the components of the material developed are correct and in accordance with the reference taken. While construct validity is related to consistency and the relationship between one component and the other components. Furthermore, in this study valid criteria for product development are based on expert opinion with the following criteria: (1) the results of expert assessment show that the product development along with its supporting aspects have strong theoretical aspects, and (2) the results of the expert assessment show that the development products and their supporting components are consistently interrelated and have a valid assessment level.

Based on the study's findings, it is clear that the authentic assessment model established is quite useful. This is because the materials used to support the implementation of this authentic assessment model are very cheap and easy to obtain. In real terms the effectiveness of learning using the developed tools includes good

categories. For this purpose, the teacher's assessment sheet is used, and the observation sheet is the implementation of authentic assessment in problem solving learning [26].

Effective learning tools are learning tools which can deliver students to achieve learning goals in a predetermined time. The product of development is called effective when students appreciate the learning program and that desired learning takes place, meaning that students value learning and learning programs that are planned to be implemented according to the learning target. Effective learning tools provide a rich learning experience and optimum students' learning outcomes. Learning devices in this case in the form of authentic assessment instruments developed are considered effective if the teacher can provide an assessment of student development quickly and precisely [33].

The development of authentic assessment models in problem solving learning refers to the learning of High Order Thinking Skill (HOTS), one of which is problem solving learning. The authentic assessment model developed consists of problem-solving activities, time allocation, assessment observation sheets, description of problem-solving abilities, problem solving ability criteria with all the tools to assess students' development.

Based on the results of reliability statistics calculations, the inter-item correlation matrix, and the inter-item correlation matrix for authentic assessment models in problem solving learning, it can be seen that this authentic assessment model in problem solving learning developed, from the aspect of practicality has very good criteria, from the aspect of effectiveness has very good criteria, and from the aspect of implementation, has good criteria. The level of reliability of this authentic assessment model is very good. Thus it means that the authentic assessment model developed has very strong consistency, stability, and stability to assess problem solving learning activities for students.

Based on data analysis, it can be seen that the level of agreement between teachers regarding the practicality, effectiveness, and model has a very strong level of agreement. This means that the teachers have a very strong agreement that the authentic assessment model developed is very practical, very effective and this authentic assessment model can be easily implemented to assess students' abilities in problem solving learning in early childhood education. The development of authentic assessment models in problem solving learning refers to learning from High Order Thinking Skills (HOTS), one of which is problem solving learning. The authentic assessment model developed consists of problem-solving activities, time allocation, observation sheets assessment, description of problem-solving abilities, problem solving abilities and all the tools to assess students' development.

The results of reliability statistics calculations showed that the inter-item correlation matrix, and the inter-item correlation matrix for authentic assessment models in problem solving learning, it can be seen that this authentic assessment model in problem solving learning developed, has a very good criterion, aspect of effectiveness as very good criteria, and from the aspect of implementation, has good criteria. The level of reliability of this authentic assessment model is very good. Thus, it means that the authentic assessment model has been developed very strong consistency, stability, and stability to assess problem solving learning activities for students. It was revealed that the level of agreement between teachers regarding the practicality, effectiveness, and implementation of this authentic assessment model has a very strong level of agreement. This means that the teacher has a very strong agreement that the authentic assessment model developed is very practical, very effective and this authentic assessment model can be easily implemented to assess students' abilities in problem solving learning in early childhood education.

4. Conclusions

The authentic assessment model developed is feasible because it meets the requirements for practicality, effectiveness and implementation in the learning process at early childhood education. From the aspect of practicality having very practical criteria, the effectiveness aspect has very effective criteria, and from the implementation aspect it has good criteria and with a very reliable level of reliability (Cornbach's Alpha coefficient value (α) = 0.976). The level of teacher agreement in giving an assessment of the aspects of practicality, effectiveness, and implementation of authentic assessment models on problem solving learning at early childhood education is very good (individual Kappa (κ) coefficient = 0.846; and the average Kappa (κ) value = 0.976). Thus, the authentic assessment model developed is very suitable to be used as an instrument to assess the results of students' abilities carried out by an assessment team consisting of two or more teachers at early childhood education.

The results of the ability assessment of 44 students at early childhood education on problem-solving learning were: 8 students (18.2%) got Very Good criteria, 28 students (63.6%) with Good criteria, 7 students (15.9%) with Moderate criteria, and 1 student (2.3%) with Not Good criteria. The level of accuracy of the results of the assessment of practical learning skills carried out by the assessment team consisting of 8 teachers is very good criteria (κ mean = 0.976).

References

- [1]. Wang, S., and H. Wang. (2011). Teaching higher order thinking in the introductory MIS Course: A Model-Directed Approach. *Journal of Education for Business*, 86, 208-213.
- [2]. Sudirman, N. (2005). *Ilmu Pendidikan*. Bandung: Remaja Rosdakarya.
- [3]. Meier, D. (2010). *The accelerated learning Handbook*. Bandung: Kaifa.
- [4]. Supriyadi, E., Soenarto, S., Surwi, F and Prianto, E. (2017). Evaluating the assessment system of basic courses in the department of electricalengineering. *Journal of Technology and Vocational Education*,
- [5]. Mulyatiningsih, E. (2012). *Applied research in education and engineering*. Yogyakarta: UNY Press.
- [6]. Payne, D.A. (2003). *Applied educational assessment, 2nd ed.* Canada: Wadsworth/Thomson Learning.
- [7]. Gulikers, J., Bastiaens, T., and Kirschner, P. (2006). Authentic assessment, student and teacher perceptions: the practical value of the five- dimensionalframework. *J. Vocational Education and Training*, 58(3), 337–357.
- [8]. Mueller, J. (2005). The authentic assessment toolbox: enhancing student learning through online faculty development. *Journal Online Learning Teaching*, 1(1), 13–35.
- [9]. Marhaeni, A.A.I.N. and Artini, L.P. (2015). Authentic assessment and meaningful education: implementation of the 2013 curriculum. *Jurnal Pendidikan Indonesia*, 4(1), 499–511.
- [10]. Olfos, R. and Zulantay, H. (2007). Reliability and validity of authentic assessment in a web-based course. *J. Educ. Technol. Soc.*, 10(4), 156–173.
- [11]. Janesick, V. J. (2013). *Authentic assessment primer*. New York: Peter Lang Publishing, Inc.
- [12]. Mintah, J. K. (2003). Authentic assessment in physical education: prevalence of use and perceived impact on students' self-concept, motivation, and skill achievement. *Meas. Phys. Educ. Exerc. Sci.*, 7(3), 161–174.
- [13]. Finch, A.E. (2002). Authentic assessment: Implications for EFL performance testing in Korea. *J. Second. Educ. Res.*, 49(2), 89–122.
- [14]. Fook, C. S. and Sidhu, G. K. (2010). Authentic assessment and pedagogical strategies in higher education. *J. Soc. Sci.*, 6(2), 153–161.
- [15]. Pantiwati, Y. (2013). Authentic assessment for improving cognitive skill, criticalcreative-thinking and meta cognitive awareness. *J. Educ. Pract.*, 4(14), 1–9.
- [16]. Burton, K. (2011). A framework for determining the authenticity of assessment tasks: applied to an example in language. *J. Learn. Des.*, 4(2), 20–28.
- [17]. Ataç, B. A. (2012). Foreign language teachers' attitude toward authentic assessment in language teaching. *J. Lang. Linguist. Stud.*, 8(2), 7–19.
- [18]. Vu, T.T. and Dall'Alba, G. (2014). Authentic assessment for student learning: an ontological conceptualization. *Educ. Philos. Theory*, 46(7), 778–791.
- [19]. Branch, R. M. (2009). *Instructional design: the ADDIE approach*. Boston, MA: Springer US.
- [20]. Azwar, S. (2010). *Research methods*. Yogyakarta: Pustaka Pelajar, 2010.
- [21]. Gloeckler, L. R., Cassell, J. M. and Malkus, A.J. (2014). Teacher practices with toddlers during social problem-solving opportunities. *Early Child Dev. Care*, 184(5), 749–765.
- [22]. Lopez, M., Whittington, J. and, Susie, A. (2001). Higher-order thinking in a college course: A Case Study. *North Am. Coll. Teach. Agric.*, 2(1), 22–29.
- [23]. Shiakalli, M. A. and Zacharos, K. (2012). The contribution of external representations in pre-school mathematical problem solving. *Int. J. Early Years Educ.*, 20(4), 315–331.
- [24]. Taylor, T. D. (2014). *Identifying students for intervention in math problem solving: an evaluation of fluency-based word*. California: University of California.
- [25]. Yoleri, S. (2014). Investigation of relationship between the skills to solve interpersonal problems and concept development of preschool children. *Egit. veBilim*, 39(1), 82–90.
- [26]. Lim, S. M., Rodger, S. and Brown, T. (2017). Assessment of learning-related skills and interpersonal skills constructs within early childhood environments in Singapore. *Infant Child Dev.*, 45(1), 251–259.
- [27]. Bagnato, S. J. (1981). Developmental diagnostic reports: reliable and effective alternatives to guide individualized intervention. *J. Spec. Educ.*, 15(1), 65–76.
- [28]. Karatas, A. & Baki, I. (2013). The effect of learning environments based on problem solving on students' achievements of problem solving. *Int. Electron. J. Elem. Educ.*, 5 (1), 249–268.
- [29]. Herrington, A., Herrington, J., Sparrow, L. and Oliver, R. (1998). Learning to teach and assess mathematics using multimedia: a teacher development project. *J. Math. Teach. Educ.*, 1(1), 89–112.
- [30]. Pyle, A. and DeLuca, C. (2013). Assessment in the Kindergarten Classroom: An Empirical Study of Teachers' Assessment Approaches. *Early Child. Educ. J.*, 41(1), 373–380.
- [31]. Ebbeck, M., G., Teo, L. C., Tan, C. and Goh, M. (2014). A study on assessing developmental learning outcomes in toddlers. *Early Child. Educ. J.*, 42 (1), 115–123.

[32]. Nieveen, N. (2015). *Prototyping to reach product quality*. London: Kluwer Academic Publisher.

[33]. Istiq'faroh, N., Suhardi, S., Mustadi, A. (2020). Improving elementary school students' creativity and writing skills through digital comics. *Elementary Education Online*, 19 (2), 426-435.

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