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Development Of Learning Material Of *Pakem*-Plus For Mathematics Lesson At Elementary School

Rahmah Johar
Department of Mathematics Education
Syiah Kuala University
Banda Aceh
e-mail: rahmah_johar@yahoo.com

Abstract

Active, creative, effective, and enjoy full learning (*PAKEM*) needs to be supported by good teachers' understanding about both of content and choosing context. In Aceh Province having Islamic educational concept, it is rather difficult to find teachers who have both good knowledge and religious concept. To solve that problem, this research develops some learning material for *PAKEM* to grow optimally potential students, teachers, and culture (including the Islamic culture) and to improve the education quality, which is writer called *PAKEM*-Plus. Learning material developed consist of teacher's guidebook, lesson plan, student's worksheet, and classroom assessment for mathematics at grade 5 which satisfy validity and practicality criteria. This is a developmental research to develop a learning material. The result of this research is a learning material has satisfied validity and practicality criteria.
Key word: Active, creative, effective, and enjoy full learning (PAKEM), Islamic culture

I. INTRODUCTION

Law of National Education System No.20 of 2003 Article 40 Section 2 mentioned that educators and educational staffs are under obligation to create a meaningful, enjoyable, creative, dynamic, and dialogic educational atmosphere. These learning requirements are often entitled as *PAKEM*, which stands for active, creative, effective, and enjoyable learning. *PAKEM* is designed to enable children to be active and to develop their creativity, thus the learning processes will be effective and yet still enjoyable (Dirjen Dikdasmen, 2005). In the implementation of *PAKEM*, teachers need to give feedbacks, compliments, and reflections during the learning processes (Megawangi, 2004; van den Bergh, 2010; Mojica, 2002; Skibba, 2008). Teachers should also give various direct compliments to the students who give any answer or show any improvement.

Communication is an essential part in implementing *PAKEM*. Especially in mathematics and mathematics education, communication acts as a way to share ideas and to clarify comprehensions (NCTM, 2000; Johar, 2006). Ziemba (2007) explained that helping students to comprehend how to communicate mathematically in a class is an obligation of teachers. Then, it is important to give opportunities for students to

convey what they have known and how they acquire it. Teachers need to establish some learning environment that gives opportunities for the students who do not have confidence to participate.

The implementation of *PAKEM* in a classroom requires teachers to develop some indicator based on Standard Competence and Basic Competence by giving attention to: 1) regional potencies/contexts, 2) socio-cultures of local community, and 3) learners. With the intention to achieve the indicator, learning activities developed should: 1) give some learning experience involving mental and physical processes through interactions between student - student, student - teacher, and student - learning resources, in order to achieve basic competence, 2) use varying approaches that student-centred, and 3) include life-skills (*BSNP*, 2006).

However, Suparno (2006) stated that there is some complaint against the quality of teachers, such as the lack mastery of knowledge and the lack of professionalism while teaching in classroom. The writer also encountered these facts in the field, including the inadequate teacher's mastery of mathematics lesson so that it was difficult to develop basic competence to be learning indicators; teachers' habit to assess students' learning outcomes, which were limited to paper and pencil; and the lack of teachers' insight in integrating reality and culture in learning processes. Consequently, it was difficult to find some qualified education that produced competent, characteristic, and competitive graduates. Especially for education in NAD province, Banta (2005) explained that the implementation of Islamic education has not well accomplished yet because of the lack number of teachers having scientific and religious insight, and because of the teaching materials that have not well organized yet.

Based on the description above, there is a need to design some teaching material that can optimize students' and region potencies (including Islamic culture) in order to create some characteristic education, which writer entitles as *PAKEM*-Plus material. The material developed consisted of teacher's guide about teaching material, lesson plan (called *RPP*), student's worksheet (called *LKS*), and a class-based assessment for mathematics. These are the goal of this study. The main problem of this research is "How is the development process and outcome of *PAKEM*-Plus material in mathematics that is valid and practical?"

II. RESEARCH METHOD

The present research is a **developmental research**. Development procedures applied in this research followed the design of Plomp (2007) as described in the following.

a. Preliminary Investigation Phase

Activities conducted in this phase was studying about: (1) theories and examples of *PAKEM*, (2) learning theories, (3) theories about qualified education, (4) Acehnese cultures, (5), the field needs about the importance of inserting Islamic values in learning, and (6) Islamic values sourced from *Al-Qur'an* and *Hadist*. Besides, another activity conducted in this phase was also identifying about (1) student's conditions including skill, experience, and the use of language in communication, and (2) analysis of the material, namely identifying, describing, and arranging concepts systematically to organize mathematics lesson for grade 5 semester 1. By the considerations, it was eventually designed *PAKEM*-Plus learning material.

b. Design Phase

In this phase, learning material was designed by using Islamic *PAKEM* approach, by optimizing the potencies of some region and students for mathematics lesson at semester 1 of grade 5. The activities conducted in this phase consisted of (1) designing contexts that were appropriate with the lesson by using problems that close to students' daily life in Aceh and by inserting Islamic values, (2) designing sequences of lesson plans optimizing students' activities and the active role of teachers, (3) designing student's worksheet (*LKS*) encouraging students to find out concepts/formulas/understanding/characteristics/properties, (4) designing teacher's guidebook providing information for teachers about the description of materials would be taught and providing images for teachers in giving interventions/guidance/responses to student' behaviours during learning processes, and (5) designing class-based assessment involving the assessment of process and product. The outcome of this phase was still preliminary ideas or drafts.

c. Realisation/Construction Phase

In this phase, material of *PAKEM*-Plus was designed as the continuation of the design phase. As the result, it was produced **prototype 1,** which was a design consisting of material described in part (b) above. The prototype 1 then would be developed in the next phase.

d. Test, Evaluation, and Revision Phase

This phase was focused on two items, namely (1) validating and (2) trying out the designed **prototype 1.** This research was only focused on validating learning material theoretically and on pilot experiment. The obtained product of this research is a valid **prototype**. The activities conducted in this phase will be described as in the following.

1) Validating Material

The activities executed to validate the material are as follows.

a) Asking experts' opinions about the feasibility of the prototype of learning material developed. For this activity, instruments as validation sheets submitted to the experts were needed. The experts consisted of experts on *PAKEM*, realistic mathematics education, Acehnese cultures (including Islamic values), and the practitioners/teachers.

b) Analysing the validated outcomes from experts

If the result showed:

(1) valid without any revision, then the next activity would be pilot experiment.

(2) valid with minor revision, then it would be revised, after that it would be pilot experiment about the limited feasibility of the materials. The revisions would be executed based on the analysis of the pilot experiment, in order to obtain **prototype 2**. After that, the larger scale of experiment would be conducted.

(3) not valid, then some major revision would be conducted to get **prototype 2**. Then returned to activity (a), that is asking opinions of some experts. Cycles might be happened here.

2) Conducting pilot experiment

Pilot experiment was conducted in order to examine the feasibility of developed material and students' responses.

The research instrument used was validation sheets for *RPP*, *LKS*, teachers' guidebook, and class-based assessment. These validation sheets were aimed to achieve data about the material validity from the experts and the practitioners.

The activities of data analysis in the present research are as follows.

1) Recapitulating all comments from experts to a table, which involving aspects, criteria, and assessment results from the experts, and then searching the average result of validation from all experts, for all criteria.
2) Determining the validity of each aspect (*Va*)
3) Determining the average validity (*VR*) of each aspect
4) Determining the validity categories (theoretically), by comparing total average by the following categories

$$4 \leq Va < 5 \rightarrow \text{very valid}$$
$$3 \leq Va < 4 \rightarrow \text{valid}$$
$$2 \leq Va < 3 \rightarrow \text{less valid}$$
$$1 \leq Va < 2 \rightarrow \text{not valid}$$

Note : *Va* = average validity of assessment results from experts toward learning material for each aspect

PAKEM-Plus material called fulfils the criteria if:

(i) the value of *VA* (validity if each aspect) of *PAKEM*-Plus materials at least is in VALID category, and

(ii) *VR* value (average validity) of *PAKEM*-Plus material at least is in VALID category

5) If the validation results had not valid yet (theoretically) and needed to be revised, then revisions for the developed learning materials would be done.

III. RESULT AND DISCUSSION

The development of *PAKEM*-Plus material followed the development model that explained in the research methodology chapter of this research, that are (1)

preliminary investigation, (2) design, (3) realisation/construction, (4) test, evaluation, and revision. The results of each development phase are described as follows.

1. Result of Preliminary Investigation Phase

Results of preliminary design are as in the following.

1) Teachers' mastery about the lesson that would be taught was needed to support the implementation of *PAKEM*, thus students not only physically active (for instance sticking, arranging, exhibiting), but also mentally active (as sharing ideas, posing questions, deducing conclusions, writing opinions) in constructing knowledge associated to students real life experiences, so the education implemented become qualified education.
2) Supporting learning theories consisted of constructivist theory, inquiry theory, Piaget's learning theory, and Vygotsky.
3) Theory about qualified education was appropriated with the requirements of education in reformation era and NAD Province, because the qualified education resulted on competent and competitive graduates (that cultured and civilized, independent, religious, has moral, knowledge and skills, and innovative and competitive). Some examples of Islamic values sourced from *Al-Qur'an* and *Hadist* related to mathematics were about the introduction of speed that is related to do'a before get on a vehicle and about decreasing vehicle speed when there are congregational prayer in a mosque.
4) The initial condition of students in grade 5 at Islamic Elementary School (*MIN)* Rukoh as the place for pilot experiment have ever implemented *PAKEM* but not accustomed to relating contextual problems to Acehnese culture or Islamic values. The classroom atmosphere at *MIN* Rukoh was support enough to implement *PAKEM*-Plus because one class consisted of 25-30 students and the school location is close to Syiah Kuala University (*Unsyiah*).

From the above results of study and identification, the researcher acquired a preliminary idea to develop learning material of mathematics lesson by using

problems that close to students' daily life and by inserting Islamic values, so that the qualified education could be achieved.

2. Results of Design Phase

The material for *PAKEM*-Plus were designed in this phase. As the result, real problems were designed based on Islamic values or Acehnese cultures, teacher's guidebook, lesson plan, student's worksheet, and assessment sheet of learning outcomes. Two mathematics teachers of grade 5 elementary school were involved in designing these materials.

3. Result of Test, Evaluation, and Revision Phase

There are two result of this phase, namely: (a) result of validation and (b) result of pilot experiment.

a. Result of Validation

Validation from experts was aimed to examine content validity. The validation was executed by giving prototype 1 of learning material. The experts were asked to assess and comment the validation sheets (see appendix). The learning material was assessed by 6 experts consisting of 4 lecturers and 2 teachers.

Besides giving validation/assessment, the experts also gave constructive suggestions and recommendations. The recapitulation of validation result from experts on mathematics is presented in the following table.

Table 1. Validation Result for Materials of PAKEM-Plus on Mathematics

Component	Result of Expert's Validation
Teacher's guide	Va= 3,2
Lesson Plan (RPP)	Va= 3,1
Students' worksheet (LKS)	Va= 3
Assessment	Va= 3

From the table above, it can be seen that in average, the validity for each aspect (Va) from each expert toward validated learning material satisfy the

valid category for mathematics lesson. Therefore, the average validity for all aspects validated fulfils the validity criteria. In order to understand the written comments, then the researcher needed to ask oral explanation from the experts. Moreover, on August 15th, 2009 before pilot experiment, the researcher conducted a workshop for grade 5 teachers of elementary school that took place in microteaching room of Teacher Training Faculty (called as *FKIP*) *Unsyiah*,. Participants of this workshop were 34 people consisting of lecturers (from *FKIP Unsyiah* and *Tarbiyah IAIN Ar-Raniry*) and *PMRI* (Indonesian abbreviated for Realistic Mathematics Education) partner teachers that have already implemented *PMRI* and *PAKEM*. One of the activities in this workshop was modelling of some material developed, namely the area of trapezoid and speed. Besides, another activity was asking the participants to give written comments towards the material. From the modelling, the researcher got some inputs as follows.

1) The track length travelled for certain duration should be realistic.
2) The unit of the track length should be denoted in metre while the time should be denoted in minute.
3) Students should reinvent the formula of speed themselves (teacher should not give many assistances).
4) Travelled distance should be in simple number, such as 100 m or 200 m.
5) The context for kite problem should be associated with the song of Aceh and the context associated with the trapezoidal sides of the ship wake and prayer while riding

Based on the modelling experience in the workshop and pilot experiment, there were some revisions as follows.

1) The track travelled by students while doing activity in the schoolyard to determine the speed should be in simple number, such as 100 m and 200 m.

2) Word problems dealing with trapezoid in individual worksheet should be described in brief sentences.
3) Determining the area of kite in grid paper should be directed through a half of rectangle approach.
4) Worksheet for group should be done in school, while individual worksheet became homework

b. Result of the Pilot Experiment

The pilot experiment was conducted on 3rd, 5th, 7th, and 14th November 2009 in fifth grade of *MIN* Rukoh, Banda Aceh. The pilot experiment was conducted to collect data about the feasibility of material and students' responses. The results of pilot experiment are as follows.

1) Word problems about trapezoid in individual *LKS* in Islamic context were very long
2) Calculating the area of kite on grid paper took long time because the grids were very small and could not be merged with other grid papers (it should be made as half of rectangle)
3) Students complained because there were too many task in the *LKS*: group *LKS* and individual *LKS*
4) The numbers used in the problems were too big to determine the area of trapezoid and kite, such as 10 cm, 12 cm, and 20 cm.
5) Students still got difficulties to determine the volume of rectangular prisms from pictures of unit cubes, students should determine the volume of rectangular prisms by using concrete objects and pictures of concrete objects.

The development processes of learning material described above have gotten prototype 2 of *PAKEM*-Plus learning material that satisfied valid and practical criteria. The referred learning material consisted of teacher's guidebook about the lesson, lesson

plan (*RPP*), student worksheet (*LKS*), and class-based assessment for mathematics lesson that satisfied valid criteria.

Mathematics learning device that was developed based on the context that is close to an issue that occurs around the students, Acehnese culture and Islamic values. Based on the input when the workshops and pilot experiment is known that this integration can make the lesson interesting and motivate students to learn to be increased. Thus the teacher is trying to improve students' communication and confidence in solving math problems. This is in accordance with the opinion Ziemba (2007) that teachers need to create a learning environment that provides opportunities to students who lack confidence to participate.

Constraints are obtained when the developing device PAKEM plus is the lack of references and teacher knowledge of Acehnese culture and Islamic values to be inserted in teacher's guide and worksheets about learning mathematics. The same problem was also found for Bahasa Indonesia and Science subject (Johar et al., 2009). This obstacle can be overcome by discussions with several lecturer and teachers in the workshop. It also conducted discussions with the culturer of Aceh. This is in accordance with the opinion of Banta (2005) that the implementation of Islamic education in Aceh are not performing well because the teaching staff who have a scientific insights as well as religious teaching materials are lacking and not well ordered.

IV. CONCLUSION AND SUGGESTION

Conclusions deduced according to the results and the discussions above are as follows.

a. *PAKEM*-Plus learning material was developed through phases stated by Plomp, namely, (a) Preliminary experiment phase, (b) Design phase, (c) Realisation phase, and (d) Test, evaluation, and revision phase.
b. The result got from this development phases was *PAKEM*-Plus learning material consisting of (a) teacher guide, (b) lesson plan, (c) student worksheet, and (d)

classroom-based assessment. Based on the validation and pilot experiment, this learning material had satisfied valid criteria.

According to the conclusions above, it is suggested several things as follows.

a. Teacher that have knowledge as well as religious insight is needed to implement *PAKEM*-Plus, especially in NAD province that apply Islamic law in each aspect.
b. In order to get the Islamic values easily, recently there is CD of digital *Al-Qur'an*, which consists of everything and can be accessed anytime. Besides, wise words also can be accessed easily through website.
c. For implementing Islamic values properly in learning mathematics, the researcher needs to cooperate with experts or religion leaders.
d. In order to get qualified learning materials, theoretical validation from experts is insufficient. Therefore, the researcher needs to continue experiment in the field to know about the practicality and the effectiveness of the learning materials.

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