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Developing Module of Fractional Numbers using Contextual Teaching and Learning Approach

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ABSTRACT

The purpose of this study was to develop a learning module of fractional numbers using *Contextual Teaching and Learning* (CTL) approach. The stages of development adhered to the stages of development proposed by Plomp (2007). To assess the quality of the module, Neeven's assessment of product quality (2007) was used. This assessment focused on three things: the validity, practicality, and effectiveness of the developed module. The validity of the module was determined by validators. Once the module was confirmed valid by the validators, the try-outs were administered to see the practicality and effectiveness. The practicality of the module was assessed from students' activity and students' responses on learning using the module. Meanwhile, the effectiveness of the module was assessed from the results of daily tests and final tests. The try-outs were conducted in class four times, and the percentage of students' scores in each meeting was above 90%, which means that students did not experience difficulties and felt comfortable in shaping their learning experience, and students' response was also positive. Meanwhile, the average daily test results of students for each meeting and the average final test results of all students were above 75. The results of these try-outs indicate that the developed module met the criteria of practicality and effectiveness.

INTRODUCTION

The focal point of developing the 2013 Curriculum is the perfection of mindset, the strengthening of the curriculum governance, the deepening and extending of the materials, the reinforcement of learning process, and the learning load adjustment in order to ensure the conformity between what is desirable with what is produced. To support the development of the curriculum which is heavily loaded with such noble

aims, adequate systems and devices are required as supports. One emphasis of the standard process of the 2013 Curriculum is that a learning process in the unit of education needs to be implemented in an interactive, inspiring, fun, and challenging way so that it motivates the students to actively participate and provide enough space for innovation, creativity and independence according to their talents, interests and the physical and psychological development of learners. Therefore, every unit of education needs to have lesson planning, implementation of the learning process, and learning assessment to improve the efficiency and effectiveness of graduates' competencies achievement. Independent learning is in line with the shifting role of teachers from his role as the primary source of learning to become a facilitator of learning. To optimize the independence of such learners, a structured self-learning material is needed, one of which is achieved through the provision of a good-quality learning module.

Concerning module, DG Dikdasmenum (2004) in the book "Guidelines for Selection and Use of Instructional Materials" explains that a module is a book written with the intention that the students can learn independently without direction or guidance from a teacher. Santia (2017) mentions, learning module is one of the teaching materials packed in a systematic and attractive way to make it easy to learn independently. Based on those opinions it can be said that a module is written teaching materials in order for learners to learn independently without direction or guidance from a teacher. Learning with a module is learning per section in sequence to achieve the overall materials following the principles of *mastery learning* (Suastika, 2016b). Using the module in learning, educational goals can be achieved effectively and efficiently. Utilizing the module, learners are guided through the steps systematically, to build up their ability to understand the material (Suastika, 2016a).

According to Mulyasa (2006), some of the advantages of modules can be expressed as the following: (1) focus on the individual skills of learners because in essence they have the ability to work independently and be accountable for their actions; (2) control on learning outcomes through the use of standards of competence in each module which need to be achieved by learners; (3) relevance of the curriculum shown by its purpose and how to accomplish it, so that learners can find out the relationship between learning and the results of learning.

The 2013 Curriculum for elementary school was developed using an integrated thematic approach from the 1st grade to the 6th grade in which the implementation is done gradually. Thematic learning is a learning system that allows students, either individually or in groups, actively explore and discover concepts and scientific principles holistically, meaningfully, and authentically (Majid, 2014). Integrated learning scheme is originated from the development of knowledge in the mind of students. This is in line with the philosophy of constructivism in which cognitive conflict in students can be addressed with some ways, one of which is self-regulation.

To optimize the integrated thematic approach, Contextual Teaching and Learning (CTL) needs to be applied. Komalasari (2010) mentions, a contextual approach is a learning approach that links between the material studied by the students and day-to-day life within the family, schools, communities, and citizens with the aim to discover the connection of the material to real life. In the contextual class, a teacher's task is to help students achieve their goals. Teachers deal more with strategy rather than giving information. The task of teachers is to manage the class as a team working

together to find something new to the class (students). The discovery comes from their own finding instead of what is told by the teacher.

Through CTL approach, the learning process takes place naturally in the form of work (tasks) and gives the students experience instead of transfering knowledge from a teacher to students (Triwahyuningtyas, 2016; Narohita, 2017). Corresponding to Triwahyuningtyas, Erman (2003) says, in contextual learning, in accordance with the growth of science, the concept is constructed by the students through the process of questions and answers in the form of discussion. Erman (2003) adds, finding is important in the learning process. Through finding, the ability to think independently will be trained, and students will be familiar with it.

Based on the initial identification in the first year of study, the characteristics of the materials used in the field: (1) only contains summary of the materials; (2) day-to-day tasks contain questions that only accentuated the numeracy skills course; (3) less attractive in appearance; (4) the language used is not communicative; (5) there is no feedback; and (6) the presentation of mathematical concepts in the thematic books is still lacking. The use of such instructional materials is that students have difficulties in understanding the mathematics materials, and the individual ability develops less optimally.

In addition, the observations also reveal: (1) the unavailability of mathematics books to support learning numbers using CTL approach, (2) many teachers at the observed schools still do not understand CTL approach, (3) the learning process that involves the learning of mathematics in elementary schools tend to use conventional methods, (4) no modules are used in learning, and (5) the questions in the books and worksheets used in the six schools do not apply contextual approach.

The analysis of the materials related to the learning of Mathematics, students of grade IV and V in elementary schools in Lawang still have difficulty in understanding and performing arithmetic operations dealing with fractions. This is understandable because when fractions were taught, the concept of "fragments as a part of a whole" became the sole focus of the learning process. The problem is that understanding fractions as part of the whole is not enough to support the child in solving problems involving multiple fractional representation (Sari, 2017). It is also in accordance with Bastürk(2016), *the studies about fractions have identified many misconceptions of students. The main reason for these misconceptions is that, in the teaching of fractions, one early passes to operations and numerical representations without understanding the important elements of fractions such as dividing a whole into equal parts, identifying a unit, unitizing and re-unitizing etc.* To overcome this, we need a step-by-step concepts embedding that guides students to find concept of fractions by themselves by correlating previously learned materials. Once students understand fractions, and teacher can promote their comprehension of the operations of addition, subtraction, multiplication, and division.

Based on the results of the initial identification, a learning module for fractional numbers needs to be formulated using CTL approach for grade IV. The CTL elements emphasized in the compiled module are making a meaningful relationship through the provision of examples in everyday life, giving problems in the form of problem posing, and open ended questions in which the activities in the module require students to be independent. In order to let students interact with their environment, some activities must be done in pairs.

This research generally aimed to produce a valid, effective, and practical fractional-numbers learning modules by developing eight elements of the CTL approach. In particular, this study aimed to: (1) validate the CTL-induced fractional-numbers learning modules, (2) identify the practicality of the CTL-induced fractional-numbers learning modules fractions, and (3) identify the effectiveness of the CTL-induced fractional-numbers learning modules.

The virtue of developing teaching materials in the form of a module developed using CTL is the effort to improve the quality of learning to get a meaningful learning, especially in learning numbers. The fractional-numbers learning module is expected to assist teachers in developing learning materials available in teachers' books and students' books, improving students learning outcomes in understanding the fractions, improving cognitive abilities through problem solving, increasing independence, and motivating students to learn.

METHODS

This study was a developmental research, as it generated a product that is the fractional-numbers learning module using CTL approach. The development of the product followed the stages of development proposed by Plomp (20017), namely: (1) preliminaryresearch,(2) the prototyping phase, and (3) assessment phases. To see the quality of the modules, the product quality assessment from Neeven (2007) was used. The assessment of the product quality was related to the validity, practicality, and effectiveness of the module. The validity of the product was determined by the validators, whereas the practicality and effectiveness of the products were assessed when testing the product in small classes.

1. The validity of product
   The validity of the product was determined by the validators. To determine the validity of the developed product, Validation Sheet was used. This validation sheet consists of five aspects, namely: (1) Expediency of the content, (2) the aspects of CTL, (3) legibility, (4) presentation, and (5) display. Validation was done by 3 (three) validators. The first validator was a learning expert, the second validator was an expert in math education, and the third validator was a practitioner. The practitioner was an elementary school teacher. The product was considered valid if it got an average score at least 3.
2. The practicality of the product
   The practicality of the product was assessed when testing the product in the field. The practicality of the product was judged based on: (1) students' activities and (2) students' responses. Students' activities will be assessed by the observer using Student Activities Observation Sheet (SAOS).Meanwhile, students' responses were obtained from Student Response Questionnaire.
   SAOSwas filled in by the observers for each meeting. SAOS consisted of eight statements. The maximum score for each statement was 4. The score obtained from SAOSwas converted into the following formula.

$$SK_n = \frac{TotalScore}{Maximum\ Score} \times 100\%$$

Description:
SK_n= Percentage of students' activities score in each meeting

Table 1. Conversion Score of Students'Activities in Learning

Score (%)	Category	Description
$80 \leq SK_n \leq 100$	Practical	Students have no difficulty and feel comfortable in shaping their learning experience
$60 \leq SK_n < 79$	Quite practical	Studentshave little difficulties but still feel comfortable in the shaping their learning experiences
$40 \leq SK_n < 59$	Lesspractical	Students experience many difficulties and feel quite uncomfortable in shaping their learning experience
$SK_n < 40$	Not practical	Students experience many difficulties and feel uncomfortable in shaping their learning experience

The product was said to be practical if the following criteria were met:

- Activities of students in were under "*practical*"category
- Class response (including class response to specific aspects) was under "*positive*" category
  - Class response was said to be *positive,*if the average score of the questionnaire was at least 3.
  - Class response to specific aspects was said to be *positive*,if the average score of the questionnaire to specific aspects was at least 3. The abovementioned aspects were: (1) the legibility, (2) the aspects of CTL, (3) the presentation, and (4) the display.

3. Effectiveness of the product

Product wassaid to be effective, if it met the following criteria:

- The average score of studentsdaily test at the end of every section in the module was at least 75.

The average score of student's final test was at least 75.

RESULTS AND DISCUSSION

The recapitulation of validation results is shown in Table 2.

Table 2. Recapitulation of Validation

Aspects	Average Score of Validator 1	Average Score of Validator 2	Average Score of Validator3	Average Score
Expediency of Content	3.50	3.25	3.74	3.30
Aspects of CTL	3.20	3.20	3.40	3.26
Legibility	3.00	3.00	3.33	3.11
Presentation	3.00	3.25	3.00	3.01
Display	3.50	3.75	3.50	3.58
Total Average				**3 , 31**
Description				**Valid**

The module that had been declared valid by the validatorswas tested in try-outs to see the practicality and effectiveness. The recapitulation related to practicality is shown in Table 3 and Table 4. The recapitulation related to effectiveness is shown in Table 5.

Table 3. Recapitulationof Students' Activities in Learning

Meeting	Scores of students' activities	SK_n	Category
1	29	90.625%	Practical
2	29	90.625%	Practical
3	29	90.625%	Practical
4	30	93.75%	Practical

Table 4. Recapitulationof Students' Response Questionnaire

Aspects	Average
Aspects of CTL	3.6
Legibility	3.5
Presentation	3.7
Display	3.8
Average	**3.65**

Table 5. Recapitulationof Test Results

Daily Tests	Average Score
Module 1	91.9
Module 2	93.6
Module 3	90.6
Final Test	84.8

The discussion focuses on two points: (1) the results of the modulevalidation, and (2) the results of the module try-outs.

1. Results of ModuleValidation

Regarding validation, the average score of each validator was more than 3, indicating that each validator declared the designed module as valid. If seen from each component of each aspect, it turns out that the average score was also more than 3 for each validator. This indicates that the expediency of content, aspects of CTL, legibility, display, and presentation were also valid. Therefore, it can be said that the designed modulemet the validity criteria that it could be utilized in the classroom to see its practicality as well as its effectiveness. Although it was declared valid by all validators, there were a few revisions in the form of criticism and suggestions. The revisionswere minor, there was no need for revalidation.

2. Results from Module Try-outs

The module try-outswere conducted in order to explore the practicality and effectiveness of the module that was declared valid by the validators. The try-outs wereadministered four (4) times. The first try-out was to test the "Let's Get to Know Fractions" module, the secondtry-outwas to test "Addition and Reduction Operation for

Fractional Numbers" module, the third try-outwas to test "Multiplication and Division Operation for Fractional Numbers"module, and the fourth try-out was to test "Converting Fractions to Decimal Form and Vice Versa"module.

Activities of students in each learning using the module*(seeTable*3)met the category of "practical", which means that students did not experience difficulties and felt comfortable in shaping their learning experience. Likewise, students' responses towardsthe designed modules were similar *(seeTable*4). Every aspect in question (legibility, CTL aspects, display, and presentation) was "positive". Based on the results of students' activities and students' responses, it can be said that the developed modules met the criteria of "practicality".

Besides assessing students' activity and students' responses on the learning module,researchers also conducted unstructured interviews to teachers who piloted the module. The teacher said that the modules made was already "good" in terms of the expediency of the contents, aspects of CTL, legibility, display, and presentation. The problems available in the module also met the criteria of HOTS (High Order Thinking Skills). However, the teacher also suggested that the fonts needed to be enlarged in size, considering the module was designed for elementary school students. To that end, the fonts were enlarged corresponding to the suggestion proposed by the teacher. This revision was not a major revision so that it did not need to be tested again.

Researchers also gave feedback to the students' questionnaire to obtain input regarding the module. There were 3 (three) points being asked to students, namely: (1) whether the instructions in the module was easy to understand, (2) whether the fractional-numbers module was easy to learn with, and (3) whether the problem provided in the module made them interested in learning fractions. Based on the data obtained, 20 out of 22students (91%) stated that the instructions in the module was easily understood; 20 out of 22 students (91%) mentioned that it was easy to learn with the module; 18 out of 22 students (82%) stated that the questions on the module made them interested in learning fractions. Based on this data, it can be said that the developed module made it easier for the students to studying fractions even though there were 18% of students who thought the problems on the module did not make them interested. These results support the results of Santika (2017) that the learning module is one of the teaching materials packed in a systematic and attractive way to make it easy to learn independently.

Meanwhile, the results of daily tests and final test results showed an average score of over 75*(seeTable*5).This means that the designed module met the criteria of "effectiveness". These results also indicated that learning modules could affect students' learning outcomes. The results of this study support Nuryana (2013), that the ability of students in the learning of mathematics falls under the category of go so that it can foster enjoyment, active participation, flexibility and also increase students' ability and understanding.

CONCLUSION

1. The fractional-numbers module using CTL approach that was designed met the criteria of validity, practicality, and effectiveness. Stages used in the development of this module followed the stages of development proposed by Plomp (2007).
2. Learning using the module could affect students' learning outcomes.

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