Fraction Dominoes as Teaching Tools Using Sets in Mathematics Teaching

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Abstract

The objectives of this study were to develop a design, to determine the appropriateness and effectiveness of fractional dominoes with set approach. This type of study was Sugiyono's Research and Development (R&D). One set of game consisted of three game devices. The game card had 2 parts; fractions and sets. The material expert assessment result was 96% and the media expert was 94% (very feasible). Furthermore, the learning outcomes showed that learning completeness reached 75%. The media produced an average difference (t-test) in the product test that was 6.1, input test was 10.64 and the learning outcomes enhancement (n-gain) in the product test was 0.8, input test was 0.76 (high). Thus, it could be concluded that the fractional dominoes game as a media with compilation approach on equivalent fraction in Mathematics subject matter of fourth-grade students was effective and feasible to use.

Keywords: Domino Card; Equivalent Fraction; Mathematics.

1. Introduction

Mathematics becomes one of contents of the learning subjects taught to the students. This statement can be found in *Undang-Undang Nomor 21 Tahun 2016* (Act of Republic of Indonesia No.21, 2016) on Standard Contents in Primary, Secondary and High Schools. Subarinah (Asvia 2013:13) explained that Mathematics basically was learning of concepts, structure of concepts, and finding relationship between concepts and their structures. Meanwhile, Suherman (Fauziah et.al. 2017:31) stated that Mathematics constituted the subject which put the emphasis on the rationality-related activities.

Ajiegoena (2014: 85) explained that the purpose of Mathematics teaching in primary schools covered the students' holistic aspects. That learning objective will attain the best results if the learning process runs effectively. In fact, we still find problem related to the Mathematics learning applications. It goes in line with Yenni B Wijaya and Andre Heck's statement (Kusumaningtyas and Sugiarto 2013: 2) that Indonesian mathematics teaching faces another problem: most pupils show negative manners towards Mathematics. Most of them find mathematics difficult and mind-numbing. This is not surprising when we look closely at the common clasroom practice of Mathematics teaching and learning in Indonesia.

The similar issue was found in primary schools. Based on the interviews and observations I had done, I found that during the learning, ask and answer, lecture, discussion, and direct instruction were most applied methods. In terms of the usage of learning supporting tools, I found a problem i.e. the applied teaching tools were one-use and unendurable, the students tended to be unenthusiastic during the classroom learning, 50% of the students did not pay full attention to the learning, and only 2-3 students were active in group discussions. From the data of grade IV students learning outcomes in SD Negeri 02 Sukorejo I found that grade points of Mathematics final exam for 2016/2017 school year were very low where 20 of 31 grade IV students in SD Negeri 02 Sukorejo (64.5%) got grade points below Minimum Mastery Point Minimal (KKM) yaitu 70.

This study is supported by some previous conducted research which developed dominoes

game as well. The study conducted by Amir and Waranda (2017: 178-186) titled

"Pengembangan Domino Pecahan Berbasis Open Ended untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa SD (Development of Open-Ended-Based Dominoes for Fraction Learning to Improve Primary Students Creative Thinking Skill)." The study shows that the students' activities of creative thinking improve. Another study conducted by Aprinawati, Iis (2017:123-134) titled, "Penggunaan Kartu Domino Bilangan untuk Meningkatkan Hasil Belajar Matematika Siswa Kelas V SD" (The Usage of Numbered Dominoes to Improve Grade V Students Learning Outcomes). The research shows the increasing activities of teacher and students during teaching and learning process. Based on that background and the related studies, I will analyze the problems through Research and Development (R&D) titled "Pengembangan Permainan Kartu Domino Pecahan dengan Pendekatan Himpunan untuk Meningkatkan Hasil Belajar Materi Pecahan Senilai Mata Pelajaran Matematika Pada Siswa Kelas IV SD Negeri 02 Sukorejo" (Development of Fraction Dominoes Game Using Sets to Improve the Grade IV Students Learning Outcomes in Mathematics Lessons Particularly Equivalent Fractions in SD Negeri 02 Sukorejo).

2. Research Method

The research design I applied was the development model stated by Sugiyono. I chose this model as it fitted the research and development I would conduct. Research and development strategy (Sugiyono, 2015:409) begins with potential and problem identification, data collection, designing preliminary form of product, preliminary field testing, preliminary revision, product testing, product revision, final product testing, final product revision, mass production. The research subject is grade IV students in SDN 02 Sukorejo, i.e. 31 students. Whereas, the try out was taken by 32 grade IVB students in SDN 02 Sukorejo. The students were made subject when I analyzed the needs of fraction dominoes game

using sets, try out, product testing (small-scale), and implementation (large-scale). The classroom teacher of grade IV in SDN 02 Sukorejo became subject when I analyzed media needs for fraction dominoes game using sets, taught for product testing (small-scale) and implementation (large-scale).

The techniques I used to collect the data were interviews, observation, questionnaire, test and documentation. Before using test as instrument, I carried out the validity and reliability tests in advance in order that the instruments are verified as valid and reliable for the data collection. The data analysis was undertaken through validity, reliability, and normality tests, z-test, t-test, and N-gain assessment. The normality test was carried out to

find if the tested data are distributed normally. Z-test was conducted to see the learning mastery. T-test was carried out to find the mean interval of learning outcomes. And N-gain was carried out to see average improvement of learning outcomes. To calculate the research data, I used Microsoft Excel 2010.

3. Results and Discussion

Fraction dominoes as teaching tools using sets were developed to encourage the learning of equivalent fraction lesson in Mathematics subjects. In respect of Mathematics teaching at school, Sumirattana, Makanong and Thipkong (2017:307) wrote that "mathematics teaching at schools must aim to develop mathematical knowledge in order to solve real life problems or situations."

Equivalent fraction is one of the lessons learnt in primary classroom learning (Permendikbud Nomor 24 Tahun 2016). Jorand (2013:46) explained "fraction concept includes understanding that fractions represent parts of an object or part of a set of object that they can be represented by fraction symbols (e.g., 1/3) and that fractions are numbers that reflect magnitudes (e.g., 2/5, 2/4, and 2/3 can be ranked from smallest to largest)." In respect of fractions teaching in primary school, Nicolau

and Pitta-Patanzi (Loc, et.al. 2017:532) said "developed a new model for understanding fraction in primary school including six factors: inductive reasoning, explanations, justifications, conceptions for the magnitude of fractions, representations and connections with other concepts."
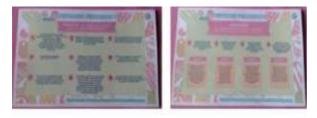
These tools were designed to create the fun learning. The concept delivered to the students is learning by playing. This was based upon the description given by Arisnawati (Komariah and Sundayana 2017:326) who explained "the teaching method designed as a game is the technique that the teacher applies to present the lesson by creating an enjoyable atmosphere. It is done in serious but casual way without disregarding the learning objective. The followings are the end-products of fraction dominoes using sets.

Picture 1. Fraction dominoes

Picture 2. Playing field

Picture 3. Game Rules

The properness test of fraction dominoes as teaching tools using sets was carried out by lessons and teaching tool assessors. The properness test of this game as teaching tool was conducted by testing lesson and tools aspects respectively. The scores of testing conducted by assessors were converted to some categories. The scores for properness test of fraction dominoes game using sets are shown on the following table.

Table 1. Recapitulation of Properness Test of Teaching Tool

Assessor for	Score	Percentage	Description
Lessons	48	96%	Highly Proper
Tools	47	94%	Highly Proper

In addition to the testing carried out by assessors, the fraction dominoes game application using sets for equivalent fraction lesson also got responses from teacher and students. I got those responses through questionnaire fulfilled by them.

Normality Test for *Pretest* and *Posttest*

Data normality test was conducted to find if grade points distributed to the grade IV students in SD Negeri 02 Sukorejo in final product testing and implementation when taking pretest and posttest was normal. Pretest and posttest scores show the calculation of liliefors test on the product testing (small group) and implementation (whole group). It was revealed that L-value < L-table so the data were normally distributed. Product testing (small group testing) showed that the scores through liliefors test on pretest was 0.128 and posttest was 0.150 so L-value < L-table i.e. 0.128 < 0.285 and 0.150 < 0.285. Meanwhile, the implementation (whole group test) showed that liliefors score on pretest was 0.149 and posttest was 0.142 so L-value < L-table i.e. 0.149<0.159 and 0.142<0.159. Based on that data, I can conclude that Ho was accepted or the data was distributed normally.

Mastery Learning Test (KKM)

Z-test was applied to test the learning mastery. The percentage picked was 75%.

H0: $\pi = 0{,}75$ (percentage of students learning mastery that meet the minimum mastery point is equal to 75% of the students being present at learning process)

H1: $\pi \neq 0{,}75$ (percentage of students learning mastery that meet the minimum mastery point is not equal to 75% of the students being present at learning process)

The calculation shows that zcount is 0.726 and ztable at significance rate 0.05 is 1.96.

so $-z_{(\alpha/2)} \leq z_o \leq z_{(\alpha/2)}$ where $-1.96 \leq 0.726 \leq 1.96$ so H0 is accepted. Thus I can make conclusion that mastery learning percentage of the students who met the minimum mastery point was equal to 75% of the students being present at the learning process.

T-test

T-test was set up to compare the learning outcomes before and after the treatment, so it was tested using one-tailed testing, i.e.: t-value ≤ t-table, Ho was accepted t-value > t-table, Ha was accepted

Ho : µ1 ≤ µ2 (Average posttest score as the grade IV students learning outcomes in the Mathematics learning SD Negeri 02 Sukorejo by applying fraction dominoes as teaching tools using sets was lower than or equal to the average pretest score). Ha : µ1 > µ2 (Average posttest score as the grade IV students learning outcomes in the Mathematics learning SD Negeri 02 Sukorejo by applying fraction dominoes as teaching tools using sets was higher than the average pretest score). In the small group testing, it was found that t-value = 6.11. It was then compared to the score of t-table using one-tailed testing with df = 8 + 8 − 2 = 14 and significance rate α 5% was 1.76. Hypothesis testing description was that H0 was accepted if t-value ≤ t-table. Based on the calculation made on the small group testing, it was found that t-value = 6.11 which was higher than 1.76 so H0 was rejected. In the whole group testing, it was found that t-value = 10.64. It was then compared to the score of t-table using one-tailed testing with df 31 + 31 − 2 = 60 and significance rate α = 5% was 1.67. So t-value = 10.64 or higher than 1.67, H0 was rejected. It means that average posttest score as grade IV students learning outcomes in Mathematics learning applied in SD Negeri 02 Sukorejo by applying fraction dominoes game using sets was higher than the average pretest one. Average small group Posttest score = 75 is better than average small group Pretest score = 55 and Average whole group posttest score = 78.71 is better than average whole group Pretest score = 62.58. it shows that the learning outcome after the learning was applied with set-based fraction dominoes game is better than before it was applied. As stated by Saadi, (2013) the learning is regarded as effective when the students get better. So I can make conclusion that fraction dominoes game using set approach is effective to be applied to grade IV students Mathematics learning in SD Negeri 02 Sukorejo.

Average Improvement Test

The final data analysis of this study was conducted by testing the average improvement (gain). Improvement margin between prestest and posttest scores was counted using gain index analysis. What is meant by Gain in this investigation is normalized gain (n-gain). Gain show the improvement of equivalent fraction lesson learning outcome after applying fraction dominoes game using set approach. The following is the formula of normalized gain stated by Meltzer (Lestari, 2015:235).

$$N\text{-}Gain = \frac{posttest - pretest}{max\ score \quad pretest}$$

The following is the description of gain index interpretation

Table 2. *Gain* Index Interpretation

Gain Index	Description
g ≥ 0.7	High
0.3 ≤ g < 0.7	Moderate
g < 0.3	Low

The sum of the average improvement test is presented in the following table.

Classroom	Assessment	Mean	N-Gain
Small Group	*Pretest*	55	
	Posttest	75	0.8
Whole Group	*Pretest*	62.58	
	Posttest	78.71	0.76

Based on the data I pick from Table 3, we can see that average score of N-Gain pretest and posttest of small groups is 0.8 and of whole group is 0.76. It means that the improvement of pretest and posttest on small and whole groups is on N-gain (g) $\geq$ 0.7 which is included in "high" category. So I can draw a conclusion that learning outcome of equivalent fraction lesson in Mathematics after applying fraction dominoes game using sets improves.

4. Conclusion

Based on the investigation, the development of domino card game as teaching tool in fraction lesson was verified as effective and applicable to the mathematics learning for grade IV students.

5. Reference

Ajiegoena, Andi Muhammad. (2014). Peningkatan Hasil Belajar Matematika Melalui Metode Pemecahan Masalah. Tarbiya, 1(1):83-94.

Amir, Mohammad Faizal & Mahardika Darmawan K.W. (2017). Pengembangan Domino Pecahan Berbasis Open Ended Untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa SD. Jurnal Pedidikan Matematika, 6(2):178-188.

Aprinawati, Iis. (2017). Penggunaan Media Kartu Domino Bilangan Untuk Meningkatkan Hasil Belajar Matematika Siswa Kelas V SD. Jurnal Pelangi, 9(2): 123-134.

Arlianti, Nofyta. (2015). Meningkatkan Hasil Belajar Matematika Siswa Menggunakan Model Pembelajaran Jigsaw diiringi dengan Media Domino Kelas VIIn MTSN Pendung Tengah Penawar. Jurnal Penelitian Universitas Jambi, 17(1): 67-71.

Jordan, nancy c., et al. (2013). Develompent Predictors Of Fraction Concepts And Procedures. Journal Of Experimental Child Psycology, 116:45-58.

Komariah, I. & Sundayana, R. (2017). Meningkatkan Aktivitas Belajar Matematika Siswa dengan Menggunakan Media Domat. Jurnal Mosharafat, 6(3): 323-332

Loc, Nguyen P., Tong, Duong H., & Chau, Phan T. (2017). Identifying The Concept "Fraction" Of Primary School Students : The Investigation In Vietnam. Academic Journals, 12(8): 531-539.

Madayani, N.S. (2016) . Improving The Students Vocabulary Mastery Through Modified Domino Cards At Elementary School. Lingua Scientica, 8(1): 91-98

uryaningsih, S., & Irianto, S. (2015). Math Games Domino Effect On The Result Of The Learning Math Fractions in class IV SD Negeri Kalikabong. Jurnal Dinamika Pendidikan Dasar, 7(2): 31-42.

Rahaju & Hartono, S.R. Pembelajaran Operasi Pecahan dengan Kartu Domino Pintar. Jurnal Ilmiah Pendidikan Matematika, 1(2):173-181.

Saadi, Fransiska. 2013. Peningkatan Efektivitas Belajar Peserta Didik Dalam Pembelajaran Ilmu Pengetahuan Sosial Menggunakan Media Tepat Guna di Kelas IV Sekolah Dasar Negeri 02 Toho. Pontianak: Universitas Tanjung Pura.

Sumirattana, S., Makanong, A., & Thipkong, S. (2017). Using Realistic Mathematics Education And The DAPIC Problem-Solving Process To Enhance Secondary School Student's Mathematicatl Literacy. Kasesart Journal Of Social Sciences, 38: 307-315.

Sugiyono. 2015. Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R&D. Bandung: Alfabeta.

Permendikbud Nomor 24 Tahun 2016 tentang Kompetensi Inti (KI) Dan Kompetensi Dasar (KD)

Undang-Undang Nomor 20 Tahun 2003 Pasal 1 Ayat 1 tentang Sistem Pendidikan Nasional.

Undang-Undang Nomor 21 Tahun 2016 tentang Standar Isi Pendidikan Dasar dan Menengah yang menyebutkan bahwa struktur kurikulum SD/MI, SDLB atau Paket A.

Widyoko, Eko Putro. 2014. Penilaian Hasil Pembelajaran Di Kelas. Yogyakarta: Pustaka Pelajar.