



Developing Board Game as Learning Media about Waste Sorting for Fourth Grade Students of Elementary School

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Abstract

The research aimed to develop a learning media in form of board game about waste sorting for fourth grade students due to the lack of students' awareness about the purpose of waste sorting. The research used descriptive method to make a description or representation about a fact from real phenomenon, which was about waste sorting that considered less important in society and must be informed since early stage. Strategy of the research was linear strategy that consisted of some phases: (1) Data Collection Phase, (2) Data Analysis and Processing Phase, (3) Product Design Phase, and (4) Testing Phase. The approach of the research was mix method, combination of qualitative and quantitative. Research subjects at testing phase were 42 students of fourth grade of St. Theresia Marsudirini 77 Salatiga, an Adiwiyata Elementary School. The result of the research showed that, (1) 95 percent of students more interested in learning using a game, (2) "Pilah Sampah" board game was well successfully delivered the learning material about organic and non organic waste, (3) using of board game as learning media alternative was rated good both by teacher and board game expert, based on product questionnaire.

Keywords: board game, learning media, waste sorting, interest of learning

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Introduction

In Indonesia, waste becomes a common problem in almost entire city. The problem is also responsibility to each individual community to participate in handle the waste in Indonesia. Various problems may arise from the scattered pile of waste. For example, the waste that may block the water flow in drainage or river may cause flood. In addition, the waste may also be a source of disease. The volume of waste that produces in big cities, such as Jakarta, reaches 0.4 to 0.5 kg / person / day (Damanhuri & Padi, 2010, p. 15). Currently, the population of Jakarta has reached about 10 million people, so it may conclude that the waste producing per day is about 4000 to 5000 tons. Calculation of waste volume is only from Jakarta, does not include from other cities in Indonesia.

The Ministry of Environment has launched program of waste processing; Reduce, Reuse, and Recycle (3R). In addition, the ministry also launched a waste bank to

accommodate the reusable or recyclable waste. For the successful of program, it needs to sort the waste into some types; organic, non organic, and hazardous materials (B3), or at least two types of waste; organic and non organic waste (Kementerian Lingkungan Hidup, 2015). Generally, organic waste may define as a decomposable waste, and non organic waste may define as a kind of difficult to decompose of waste. Waste sorting has become one of the discussions in Law number 18 years 2008. As the follow up of the law, it has available waste bins and the bins has purpose to sort the types of organic and non organic waste in along the road of the city.

The previous waste sorting system assumes to be less effective, since the garbage trucks still carry garbage simultaneously and mixed the organic and non organic waste in the same garbage truck. In the end, the waste sorting process occurs in the waste bank or Final Disposal Site (TPA). In 2015, the government

began providing garbage trucks to transport the non organic waste. It certainly makes more simple and fast in the process of waste sorting. During the garbage transport process, this truck will only take the non organic waste garbage and directly bring to waste bank, because the waste bank receives more non organic waste to reuse purposes (Faiz, 2015). Statistical data from Central Bureau of Statistics of 2013 on Percentage of Households by Province and Sorting Waste to Decompose and Difficult to Decompose, from all regions in Indonesia, only 23.69% of households are sorting the organic and non organic waste, and the rest of 76.31% household has not yet done the waste sorting treatment (Badan Pusat Statistik, 2013). People still do not understand correctly about the waste sorting function due to the lack of information and socialization from the government.

Previous research has examined the effect of education level to public awareness of waste and environment; the result showed that the influence of education level to community participation is 62.25%, while the rest is influence to society attitude. Education plays a high role to determine the community awareness to their environment (Saputra, 2010). Education on waste processing and the environment is needed by children since early because children may throw the waste carelessly due to there is no education from early time – it is feared the habit will be impact to their adulthood. This certainly related to the school's role in teaching the environmental concerns.

The results of interviews conducted to Head Master of SD (Elementary School) Adiwiyata St. Theresia Marsudirini 77 Salatiga, - the research place, show that the learning material of waste sorting may be delivered starting from the fourth grade of elementary school because at that grade level, students obtain the lesson about sorting and recycling waste. In sort, it is also suitable to teach about environmental cleanness in certain limits. Adiwiyata School prioritizes students to concern with the environment, if small things like waste sorting has failure to be teach then Adiwiyata School will be also failure to perform its function. It needs an interesting learning media to assist the teachers' explanation about waste sorting of organic and non organic, so the students are able to understand better.

The design of learning media should consider some learning styles, especially children learning style. According to DePorter,

the kinds of learning styles are; (1) Visual learning styles; focusing on vision - means the concrete evidence must give first. Evidence may be in the direct observation, pictures, colors, shapes, and other visual forms. People who are prefer to visual learning styles usually tend to see the attitudes, motions, or teacher's lip – they are not a good listener while communication and prefer to display than oral explanation. (2) Auditory learning styles; use hearing sense to understand and remember the lessons. People who are prefer to auditory learning styles usually remember well the teacher's explanations or discussion materials, difficult to understand information in writing form, and tends to communicate directly with the environment. (3) Kinesthetic learning style; requires the sense of touch in understand information. People who are prefer to kinesthetic learning style tend to real objects as learning aids, difficult to calm, and prefer to practice directly (DePorter, Hernacki, & Abdurrahman, 2001, pp. 116–118).

The learning media that used by the school - the research place, is often a book, but not all students can understand the information through the book. The teacher method of explaining and the student listening to teacher, it makes the students not full of concentration in the classroom. The problem in the research place is; there are a number of students who do not understand about the differences between organic and non organic waste – in fact, the material has been explained in the classroom. According to the results of interviews with guardians of grade fourth, it needs interesting and appropriate learning media to students' characteristic, especially students with learning styles who do not fit to the book as learning media. The arisen problem in the class is - some students look saturated to listen the material presented by the teacher. The expected learning media is a learning media that able to involve the direct interaction between teachers and students. Compared to other learning media alternatives such as movies, videos, comic books, and others, games become the best alternative that suits to characteristic of students or children. The selection of games as an alternative learning media is also supported by the results of the students' choice about their response to a new learning media - more than 50% of students choose games media than video or comic books.

For generations, games have considered as a waste of time. The children are considering

as not able to do useful things, and they are supposed to play to spend their time. But since the changing of the century, there has been a change in view of play due to the scientific study of aspects contributed through playing for the development of children. Scientists have proved that playing is a valuable learning experience (Hurlock, 2013). According to child psychologists from *Tiga Generasi*, many studies proved that the game can train the children's abilities, including thinking skills, language, motoric, and emotional restraint (Sukmasari, 2016).

Games are generally categorized into Digital Games and Board Games. Digital games are usually independent and can be self-played, meanwhile Board Games require more than one person to play (Isa, 2015). In classroom learning, Digital Games media is difficult to implement because students are not allowed to bring gadgets to the classroom and also the games are individual. In Board Games, students are invited to interact with their friends and teachers, and board games can also be played by more than one person.

According to a board game publisher company in Indonesia, board game is game in which there are rules of play and complete with components such as tokens or pawns that they may move on a special board (Anonim, 2014). Board games are part of the tabletop game which is played on the table. The more clearly the game board simulates the real events, and then the students' learning understanding is better through board games. Previous research has discussed the design of farming game board. The research was succeeded and concluded that the success of the board game depends on the rules of the game which is clear and interesting of visual concepts. After playing the board game, some players more understand to type of plants for planting in gardens (Istianto, Tanudjaja, & Suryo, 2013).

The board game has several advantages than others media alternatives. Unlike movies or videos that only create one-way communication; the students only hear and watch on screen, the board games media can generate two-way communication between teachers and students, and students with other students directly. Not only build the communications, but the board game also builds the students' skills in reading comprehension because to play the game, students have to read and understand the guidance of the game. Board games can be

easily played by students because it does not require gadgets such as mobile phones or computers, and also it prevents the students' vision from the danger of screen radiation. The game board includes of all the three learning styles; visual, auditory, and kinesthetic – it means that almost all students with different learning styles are easy to understand the material through board games.

Teachers need the game board media to assist in teaching learning process in the class. And then, The research aimed to develop a learning media in form of board game about waste sorting for fourth grade students due to the lack of students' awareness about the purpose of waste sorting. The research objectives are (1) for teachers, especially for elementary school teachers, through the instructional media in the form of board games can help teachers in deliver the materials about waste sorting which is in different and interesting way. In addition, it also helps to build two-way communication between teachers and students, (2) for students, especially elementary school students of fourth grade, through the educational board game able to make the students more understand about the waste sorting of non organic and organic. In addition, it also trains the ability to blend with others, (3) for parent, through the educational board game, parents can understand about the waste sorting function and provide a dumping garbage at home as a realization. In addition, parents can also teach about the waste sorting to children in more interesting way.

Method

Descriptive method was used in the research. Descriptive method is a method to examine the status of a group of people, an object, a set of conditions, a system of thought, and or a class of events in the present. The purpose of descriptive research is to make the description, image, or explanation systematically, factually and accurately about the facts, characteristic, and relationships among the investigated phenomena (Mohammad, 1988). The research was conducted at St. Theresia Marsudirini 77 Salatiga; an Adiwiyata school from January 2017 to September 2017, with a total population was 42 students of fourth grade. The research included of initial interviews till the final product. The research instrument was a closed questionnaire for students and interviews with teachers. Data analysis technique was a

mixed analysis technique between qualitative and quantitative by analyzing the obtained data from research instrument.

The research strategy was a linear strategy where there were several phases coherently in a logical sequence. The flow of phase is presented in Figure 1.

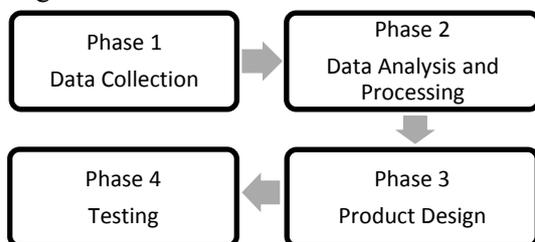


Figure 1. The flow of research phase

The first phase, data was collected through an interview with the Head Master of SD (Elementary School) Adiwiyata St. Theresia Marsudirini 77 Salatiga on the selection of grade levels that fit to the topics; waste sorting. Interview was also conducted to the guardian of fourth grade on the students' in-class learning experiences. Not only interviews, but data are also obtained from books, online news media, and previous research journals about waste sorting, instructional media, and board games.

In the phase of data analysis and processing, it discusses the relation between the data collection in the first phase and the solution of the problems; that is board game. In the board game development process of waste sorting, it invited game board experts who are the winners of the national board game competition and Board Game Challenge, and direct consultation to the teacher in the research place.

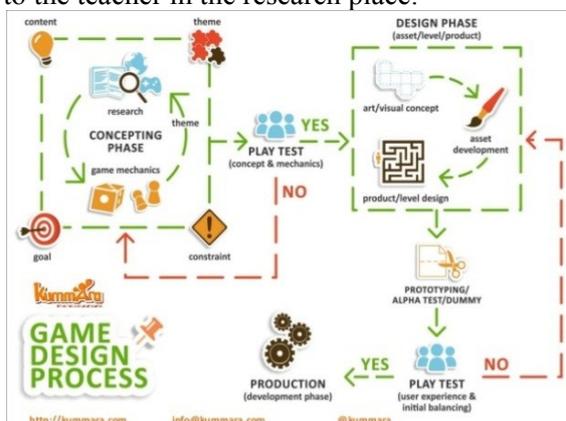


Figure 2. Game Design Process (Nugroho, 2013)

The third phase, the product design used Game Design Process diagram by CEO

Kummara, a game company that focuses on the serious game, gamification, and interactive system design (Nugroho, 2013). The diagram of the game design process is presented in Figure 2.

Game Design Process is divided into several phases, which are (1) Concepting Phase; the data analysis results are loaded in the form of game elements, such as themes, game guidance, components, and stories. The result of the phase is prototype. (2) Internal playtest sessions; the prototype or game prototype is played by designer teams to examine whether the game has running well to the end and or the concept of game has delivered. The prototype at this phase is a basic component to simulate some rules in the game. The prototype is usually only a piece of paper and pencil writing, without excessive picture design. Prototype will always be updated according to the suggestion or input toward the game development. (3) Design Phase; the game prototype is improved and added by visual elements aiming to help the player more understand the game. In addition, at this stage also conducted a balancing of the game, so the game will be fair and balanced for all players. (4) Prototyping and blind playtest; item that is considered in the section is the experience of play, such as visual clarity, well game sequence, game balance, and fair for all players. The prototype in the phase is a prototype that has passed the design phase. (5) Production and Development; the production phase that conducted after the game passed the intensive playtest phase repeatedly and consider the board game has feasible to publish to target consumers. At this phase, game development is still conducted in various aspects.

The fourth phase is testing. The analysis technique was a mixed analysis technique, where quantitative and qualitative research methods are used in a research activity, so it obtains data in more comprehensive, valid, reliable, and objective (Johnson & Christensen, 2014). Quantitative data was obtained after the test, from a closed questionnaire with Likert scale which contained items about the product and the students' interest in learning using board games. The assessment of teacher and game board experts used a product rating questionnaire with a score scale of 1-10 to assess the feasibility of the board game. The assessment scale table is presented in Table 1.

Table 1. Expert Rating Scale

Interval	Category
> 8	Very Good
6-8	Good
4-5,9	Enough
2-3,9	Less Good
< 2	Bad

Qualitative data obtained through interview to informant which is the guardian of fourth grade about the product effectiveness on students and teachers' responses toward the students' play session. Interviews to game board experts tend to discuss the developing product about the detail of illustration, game guidance, the game duration, the game complexity for children, and the distribution of board game in order the game are glimpsed to publishers.

Results and Discussion

Data Collection Phase

At this phase, the problem identification of waste is conducted firstly by collecting data from various sources. First, the problem identification is conducted through direct observation in along of Diponegoro Street, Salatiga Town, Central Java, Indonesia. The organic and non organic garbage bins are found on sidewalks along the street. Almost in every garbage bins found the waste that does not fit in place of garbage bin, such organic waste is in non organic bins, and vice versa. The wrong of waste disposal according to its type is presented in Figure 3.



Figure 3. Plastic waste in organic bins (Researcher Documentation, 2017)

By the existence of the concrete problem, the data collection is continued by searching the theoretical data from books, journals, and experts' interviews. And then, the collected data are analyzed and looked for the best alternative

solution. The collected data will be analyzed at next phase.

Data Analysis and Processing Phase

According to the data, the comparison of scattered pile of waste that produced in big city and small towns is not significant different. The scattered pile of waste produced in small town reaches 0.3 to 0.4 kg / person / day; meanwhile in big cities reaches 0.4 to 0.5 kg / person / day (Damanhuri & Padmi, 2010, p. 15). If there are one million people living in the settlement, it will produce waste about 500 tons/day. If there does not respond quickly, the waste may cause problems, such as floods, disease, and so on. The Ministry of Environment has implemented program of Reduce, Reuse & Recycle (3R) with waste sorting system. The garbage trucks have also divided into organic and non organic. If the community does not participate in the sorting waste system, then the 3R process that will conduct in waste bank in each region will meet any obstacle.

In the research journal about the effect of education level toward the community participation to waste management, found that the influence of education level toward the community participation to waste management is 62.25% (Saputra, 2010). This provides a strong reason that education has a significant effect on public awareness to waste issues. The earlier of information about the waste sorting, it will be better. School is the best place to teach about waste sorting, both in theory and practice. The school for the particular research is SD (Elementary School) Adiwiyata St. Theresia Marsudirini 77 Salatiga, where Adiwiyata School is a school aiming to make students become a generation who care about the environment. Teachers also better understand about the students' needs and the students' limits in gaining material about waste sorting.

The first interview was conducted to the head master; found that the waste sorting material until the recycling phase is taught in schools starting from fourth grade. School needs a learning media to attract the students' interest. The next interview was conducted to the guardian of fourth grade; found that the students will prefer to learn in the classroom with a variety of learning media, and do not use only textbooks as learning media. It also discussed about the scope of waste sorting material in the classroom. Material scope is required in the product design process, so the product results

can appropriate to the students' needs and schools. The teacher's need is a new learning media that can attract the students' interests, especially about the waste sorting materials.

The process of learning in the classroom involves both teachers and students so it also required data of students' need. Students of fourth grade are given choices to choose the learning media. The alternative options are video media, games, or comic books. Most of students chose game as the learning media. By the data of teachers' need and students' need, then conducted an analysis of the game media that appropriate to use in the classroom.

Games become one of the interesting media to children. The game is divided into two broad categories which are Digital Games and Board Games. In group learning, it needs games that can be played in a group; the digital game is more individual, and then board game is used as alternative. Board games become the solution as a learning media for the research place. Board Game has good potential to become a learning media. According to an article on boardgame.id - the Indonesian board game news portal website, mentioned that in the Z generation or millennial generation, learning is more effective through playing. In addition, board games that combined playing activity, study, and communicating activities are assumed as the reason about the increasing popular of the game in the community (Amaliacindra, 2017).

Product Design

Concepting Phase

In the phase, the data is associated with the game of scopes, goals, contents, and themes. The scopes of the "*Pilah Sampah*" board game is determined from the material in fourth grade. The waste sorting is limited to types of organic and non organic waste only, which are often meet by children, such as banana peel, orange peel, banana leaf, dried leaves, wilting flowers, rotten apple, glass bottles, newspaper, plastic bottles, snack packs, Styrofoam, and milk cartons. Not only some types of waste, but also loaded some results of Reduce, Reuse & Recycle items without the detail of process due to will increase the game complexity.

The main purpose of the game is to throw as much as waste in the correct waste bin according to the type. Students will indirectly be invited to participate and care for the surrounding waste. In addition, students can also

understand the examples of waste and where the waste should be throwing. They can learn to distinguish between organic and non organic waste. The content of the game is made according to the real situation, without adding a fantasy. The board in the game is imaged as a sidewalk and each character is a child. The using components are also minimized in order it make easy in game preparation.

After the content is determined, then it continues making stories in order the students are more understand about the game. The story in the game is; each player plays the role as children who care about the environment. Their job is to clear the sidewalks, in order they become a good example for the community. The more players throw the waste in the right place; the player will get an award or reward, a recycled card. The scenes of the game are imaged as the sidewalk where there are some organic and organic garbage bins, but there is a lot of scattered waste. In the game, the garbage collected by players will be processed into useful recyclables, such as compost, paper craft, hanging pots from plastic bottles, pencil racks from milk cartons, plane toys from Styrofoam, sewing bags from snack packs, and flower vases from glass bottles.

Based on the research results, data analysis, and the game concept, then it determined the appropriate game's mechanics in the design of "*Pilah Sampah*" board game. The game's mechanics are the framework of how the game works or played. For example, in the snake and ladder game, the main mechanic is Dice Rolling. In the data forum of world's largest board game is Board Game Geek, there are over 75,000 game board titles recorded and there are also 51 types of game mechanics. Not all mechanics can be applied and loaded into game content. The mechanics that assumed most representations of events in the field are pick-up and deliver mechanics. The mechanical definition of pick-up and deliver is a way of playing where players are required to pick up an item in a location and must deliver to destination to earn money, points, or other actions. In the mechanics, there are rules or other mechanics that explain the destination of goods (Vagansza, 2015). In the game, scattered waste is the goods that must be taken and delivered to the appropriate bins. The selection of mechanics has consulted to board game experts. From the interviews, the selected mechanics that appropriate to the theme and also easy to understand by people are board game.

The main mechanics are also recommended to be supported by another commonly used mechanical, which is dice rolling.

Playtest Concept and Mechanics

At this phase, the simple first prototype is made, in the form of pieces of paper and markers writing. The internal playtest phase is conducted with lecturers and members of the FTI Gamedev UKSW community. The focus on the playtest phase is the run of the game from the beginning to the end and also the conformity between the concept and the aim of the game, that is to teach about the waste sorting of organic and non organic. The first prototype had some changes in rule of play and components on the game board. Some of the slots in the board are reduced and some cards have effect changes. The first prototype image is presented in Figure 4.

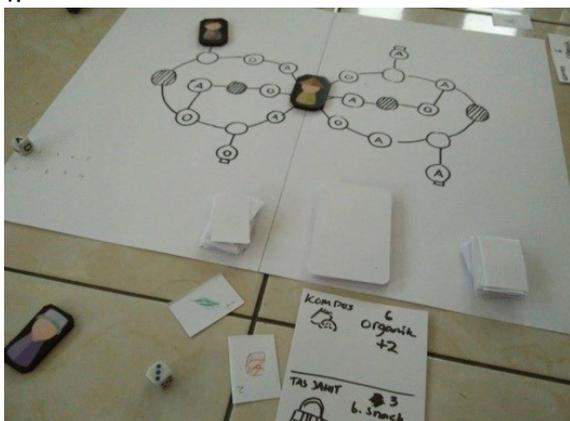


Figure 4. The first prototype (Researcher Documentation, 2017)

Design Phase

After passed numbers of playtest, the concept and rule of the game is considered as well. The next phase is the design phase, which determine the title of the game and start to make the concept of image. The title of the educational game board is "Pilah Sampah". The title is determined based on the theme and the material contained in the game, which is about waste sorting of organic and non organic, so by reading the title, the player will get an idea about the game and the material contained.

The concept of the image depends on the target consumer of the product, i.e children. An image with cartoon style becomes an option for drawing characters. Funny and simple cartoon characters can more attract the children's interest during they play the game. In contrast, aim to show the non organic and organic waste

card objects, it draws the card in a style which close to the original object. The describing of the concept of the game packaging design also begins in this phase. All characters in the game are displayed on the packaging with added by organic and non organic waste bins. Not only the concept of image, but made also some improvement in the game. The improvement includes of the addition and decrease the number of each type of card, the points of each waste card, step rules, and so on. The result of the design phase is the second prototype. The second prototype is already in print, has a simple illustration, and the right layout for the convenience of the game.

Prototyping and Blind Playtest

Blind playtest phase is different from the internal playtest which conducted only to people who understand in game field. Blind playtest is conducted to random people and target consumers who have never played the developed game. In the study, blind playtest target is a fourth grade from Elementary School of St. Theresia Marsudirini 77 Salatiga. The expected results at this stage are; students can understand the rule of the game, students are interested in the visual estimates of the game, the concept of waste sorting, and the response of students' interest during the playing. Blind playtest was conducted to four students. Some of game rules that are considered as difficult are ignored by the students, but the games are still run well and it indicates the need to improve some of the rules.

After the blind playtest session ends, conducted a short interview with the students and the guardian. Students states that playing activities while learning is fun, students better understand to the differences of organic and non organic waste, but there are some rules that are difficult to understand by the students. Students assumes that the visual or image are needs to add, especially on the characters. In the blind playtest session, there is no character description yet. Characters are described only in the form of a various color. The guardian judges that if the students are fun in the learning process while playing, then board game "Pilah Sampah" is considered as feasible to use as learning media in the classroom. Organic and non organic waste cards are considered as sufficient of types in order to introduce to students of fourth grade. Board game "Pilah Sampah" has considered as good and feasible to develop and continue to the

next process. Images of blind playtest sessions is presented in Figure 5.



Figure 5. Blind Playtest Session (Researcher Documentation, 2017)

Production and Development Phase

The second prototype continued to develop at this phase according to student and teacher response in the previous phase. Male and female characters are added to each color, which is red, blue, yellow, and green, so the children may choose from many character choices. Illustrations on game boards are made similar to sidewalks, so the game can illustrate the real situation. On game marker cards are also added the game field rules. Some rules are updated to make it easier for students to understand and play the "Pilah Sampah" board game. The negative effect cards are decreased in order to make students feel not aggrieved and the game run more fast. At this stage, teacher guides are also included which are activity

guidance after playing and class activities. After the students finish the playing, the teacher may explain the material about waste sorting and also how to recycle. Teachers can also give students the task, which bring one type of waste according to the most waste that the student collects in the game, the waste will use as recycle at the next of class meeting. For example, students who collect the most organic waste at the end of the game, they will give a task to bring organic waste and being composted in the next class meeting. The class activities in the game is expected to assist teachers in attracting the students' interest in classroom practice on waste recycling. Image of board game "Pilah Sampah" after passed the Development Phase, is presented in Figure 6.



Figure 6. Prototype after development (Researcher Documentation, 2017)

Table 2. Questionnaire Data

No.	Statement	SS	S	TS	STS	Percentage SS + S
1.	Preparation of game is easy	14	24	4	0	90%
2.	The rules of the game are easy to understand	20	15	6	1	83%
3.	The explanation of game component are easy to understand	14	19	7	2	79%
4.	The point calculation is easy to understand	22	17	2	1	93%
5.	Event card explanation is clear	24	12	6	0	86%
6.	Field function explanation is clear	15	23	4	0	90%
7.	The size card is comfortable to use	22	18	2	0	95%
8.	The character images are interesting	31	10	0	1	98%
9.	The image of organic waste is clear and interesting	30	10	2	0	95%
10.	The image of non organic waste is clear and interesting	25	15	2	0	95%
11.	The differences between organic and non organic are clear	32	10	0	0	100%
12.	The image on reward card is clear and interesting	23	16	3	0	93%
13.	The color on game is interesting (card, board, etc.)	29	12	0	1	98%
14.	The time of playing is adequate	6	15	15	6	50%
15.	More interest to learn using game	35	5	2	0	95%

Testing

The tests were conducted to 42 students of fourth grade and guardian of the fourth class. The testing phase is a playtest and is divided into two game sessions. During the test, all students listen to the rules of the game simultaneously and then divided into five groups according to the sequence of attendance book. The students who have followed the blind playtest sessions, they helped other students to play the game. The two-session test occurred for almost two hours. At the end of the play session, students are required to fill a closed questionnaire. The questionnaire contains statements with the scale of Very Strong Agree (SS), Agree (S), Disagree (TS), and Strongly Disagree (STS). The statements are about the components of the game, game rules, and the students' interest on learning media of board game. The results of the closed questionnaire will use as the material of data analysis with the expert, that is guardian of the fourth grade. The questionnaire data is presented in Table 2.

Based on the results of the questionnaire data, most of the students agreed to the entire points in the questionnaire. Quantitative data in the questionnaires were analyzed based on the percentages and influence to the alternative solutions for improvement. The total points except on the fourteenth point are in "good" category because exceed of 50% of the class population. It only needs to develop in some aspects based on the student and teacher suggestions and response.

The first point to the sixth point relates to the rules of play and the game. There are three points from six points that have a number of disagree, i.e the second point of 17%, the third point of 21%, and the fifth point of 14%. For the students, rule of play is difficult to understand. Their reason is - the rules of play is quite confusing. Explanations on game components such as game board functionality especially on event cards are considered as unclear. The improvement are conducted by reducing the rules of play - players should not able to pass the other players in a particular field, then the rule of play are changed into players may pass the other players in a particular field. The game field description on the player marker board need to make clear, so the players will more easily understand to the rules of game. In each of event card is added by illustrations to help students understand the effects of the card and

also to clarify the function of the text on the card.

The seventh point to the thirteenth point discuss about illustration and visual design of the game. In the questionnaire data, most of students agreed to the points of illustration. The different illustrations of organic and non organic waste have clearly described. Character image is updated because in the third prototype there are image lines of some characters are still unclear. Fourteenth point discuss about the duration of play, 50% of students disagreed to the duration of playing is enough. Duration of play depends on the time marker. Play session for each group is 15 minutes and it does not include the time to explain the rules of play and calculation of the points in order the session changing does not take too long. In the rules of game, the time may add 20 or 30 minutes according to the student's needs. The duration of game does not make too long so the teacher has adequate time to explain the material at the end of the game. A description of the class activities that may conduct is also attached in the game guide sheet.

The last point, 95% of students were more interested using game in learning. Students are enthusiastic in the game sessions and not patient to wait for their turn to play. This proves the students' interest to board games as a learning media. The suggestion column in the questionnaire also contains positive comments from the students, including learning through the board game is more fun and students want to play the game again. The students become more understand about the differences between organic and non organic waste because the learning material is packed in an interesting media. The image of testing phase is presented in Figure 7. The final result of board game "*Pilah Sampah*" is presented in Figure 8.



Figure 7. Testing Phase of Board Game
(Researcher Documentation, 2017)



Figure 8. Final Result of “Pilah Sampah” Board Game (Researcher Documentation, 2017)

Quantitative data and results after the improvement are analyzed with the guardian as an expert, aiming to know the product feasibility as a classroom learning media. Aspects that assessed by the guardian are the visuals and materials contained in the "Pilah Sampah" board game based on the needs of the class. The visual aspect is good and has presented the real-world situation; starting the image of organic and non organic waste and the bins are adapted similar to school's waste bin. Illustration image on event cards is clear by using of illustrations. The color differences in each character is clear so the students are not confused while playing. The character image is also appropriate to students because each characters are funny and unique. The material in "Pilah Sampah" board game is considered as good because accordance to the material in the classroom. The material is accordance to the material limitation that given at the beginning of the data analysis. The fourth-grade material at the research site teaches about the introduction of organic and non organic waste types and the recycled products, and then, according to guardian, the material has already good summarized in the "Pilah Sampah" board game.

DePorter states that the learning process is effective if the learning is fun. Teachers are required to grow student's pleasure to a subject (Kristiani & Prasetyo, 2016, p. 164). The guardian states, the students in testing phase are very enthusiastic and pleasant; moreover, the students who have not had a turn to play, they pay attention to the ongoing game sessions. Atmospheres such in the testing phase is considered effective and needed in the classroom so the learning process is not boring. Students can also answer quickly about organic

and non organic waste samples after playing - it indicates the enthusiasm of students in learning while playing does not reduce the concentration in understanding the material. Guardian assumes the board games may develop for other subjects.

The final product results are assessed by the guardian and board game expert in 1 to 10 scale product assessment questionnaires. Scale 1 refers to strongly disagree and scale 10 refers to strongly agree. The questionnaire contains the statement about the product that is, (1) The packaging of the product is interesting, (2) The rule of play is easy to understand, (3) The illustration is interesting and easy to understand, (4) The material limit is adequate, (5) Material about waste sorting is clear, (6) The product is feasible to use as an alternative of learning media, (7) The product is interesting to play, (8) Board game is effective as a means of delivery of school education material. The questionnaire result of product assessment is presented in Table 3.

Table 3. Questionnaire Result of Product Assessment

Respondents	Average Score	Category
Guardian of the fourth grade	7,3	Good
Board Game Expert	7,1	Good

Conclusion

Based on the data from the product assessment, the assessment of game board experts who are the winners of the national board game competition, and guardian teacher at the research place, it may conclude that the board game is categorized good as an alternative learning media. The "Pilah Sampah" board game successfully delivered the material about the waste sorting of organic and non organic. The "Pilah Sampah" board game is rated good to attract the students' interests in learning by the guardian in an interview after the end of the testing phase. In its development, board games are very flexible and may develop as a learning media on other subjects, such as Mathematics, Indonesian, IPS (social science), and so on. The more innovative learning media teachers use, the more interested students will learn. Board games "Pilah Sampah" in its development will be provided to schools and produced for the education purposes.

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