Prajurit Alam: Introduction to Waste Separation Education for First and Second Grade Elementary Students

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Abstract. Indonesia has the biggest archipelagic country in the world. This making Indonesia the second largest plastic waste contributor to the ocean. The largest number in urbanization is in Jakarta, which has the most massive waste. The lifestyle of mixing waste at the time of throwing away is caused by the previous generation’s daily lifestyle and the present age. This lifestyle is what endangers the environment. The level of awareness about waste management is still low and needs to be improved. Environmental organizations focus on educating people on face-to-face education. Children are the nation's future generation. The problem is that there is no learning style and education for elementary schools about the waste introduction and waste management. For data collection, the instruments used were visual observation, interviews, and literature study. The authors also analyze and visualize based on the data obtained from the research method. The results of using visually appealing and interactive stories are very appropriate and right on target, which can improve children's ability to focus and receive messages. In this research, we can conclude that it is crucial to educate the future generation to change sustainable lifestyles as early as possible. This design provides knowledge to increase public awareness, especially elementary school students, to participate effectively in educational activities in implementing waste management systems. As a result, learning can be delivered to children through media, such as interactive and visually appealing stories. Furthermore, although the media design has been carried out for this research, further research is still needed.

Keywords: waste management, children learning style, educational tools

1. Introduction

Every day each people in society has their daily activities. To do activities, human needs to buy their goods. Each good have a different replacement period. Frequent consumption of these goods will
generate waste in solid, liquid, or gas [1]. The solid waste consists of municipal waste, biomedical waste, electronic waste, and hazardous waste from municipal, agriculture, and industrial [2]. Landfills with mixed waste can produce gas, pollute water, expose wind with litter, and draw parasites. Organic waste that decomposes under uncontrolled anaerobic conditions can produce large quantities of methane [3]. The composition and characterization of waste depending on their varying physical and chemical properties. These features are based on the urban way of life, economic circumstances, waste management laws, and industrial structures. Metropolitan cities in developing countries practice poor sanitation, water supply, public transportation, and waste management. Due to the country's low and middle income, landfills are often chosen as dumpsites because they are cheap [4]. Indonesia produces 65,200,000 tons of waste in 2016, making Indonesia the second largest plastic waste contributor to the ocean in the world [5]. Urban cities such as Jakarta have the most massive waste, producing 6,234.44 tons of waste per day, with 58.83% organic waste and 41.17% inorganic waste [6]. These are daily waste in Jakarta by Sistem Informasi Pengelolaan Sampah Nasional in 2018. Kepulauan Seribu has 17 tons, Jakarta Timur has 1844 tons, Jakarta Pusat has 2191.51 tons, Jakarta Utara has 1160.11 tons, Jakarta Selatan has 1577.73 tons, and Jakarta Barat has 1300 tons [7]. In landfills, the wastes are mixed, and this is not the right way of waste management. The key to having adequate waste management, sorting trash, must be practice [8]. It is almost impossible to sort the litter in landfills, so it is more convenient to sort the waste from the trash's origin. Technology is an important aspect, but waste management education should not be neglected as it is a root of the problem, people's environmental awareness is low. One of the educators can be in the form of environmental organizations [9]. The lifestyle of mixing waste when disposing of is caused by previous and present generation's daily lifestyle. Educating the next generation can change this ongoing lifestyle [10].

The target audience is elementary students in the first and second grades. Focusing on the school that uses the 2013 curriculum, the language used in the project will be in Indonesian. The problem is that there is no learning style and education for elementary schools regarding the introduction and management of waste. Two research questions arise from the existing issues: What are the best learning and education styles appropriate and needed by the target audience to increase waste management? In what form can educational media be involved for first and second-year elementary school children?

The position of this research, waste management in children was discussed in research by Choirul Amri and Wahyu Widyantoro in the International Journal of Community Service Learning, December 2017 with an article entitled "Pendampingan Pembelajaran Memilah dan Menempatkan Sampah Pada Tempatnya Sejak Usia Dini Di TK Imbas 1." According to the Special Region of Jogyakarta Governor regulation number 21 the year 2014, separating waste is the first initial step on waste management at least into three separate bins: easy to decompose waste bin, recyclable waste bin, and hazardous waste bin. This research uses a qualitative approach by analyzing the fact: (1) The students in Imbas Kindergarten 1 is still litter. The school only provides a mixed bin where the wastes are all mixed in one container. The school janitor does not clean the school thoroughly, and not enough budget; (2) School provides three separated bins for organic waste (leaves and leftover food), paper waste, plastic waste, (3) Do separating waste demonstration. The demonstration is done by teachers using two sets of the three separated bins. Demonstration involves educating the children about the differences between the wastes putting the trash in the correct bin; (4) Practicing separating waste by giving the students three types of food packaging made of banana leaves, paper, and plastic. Then the students are instructed to put the waste into the right bin [11].

This research provides only demonstrations to students without discussing or presenting visual media or illustrations. The second research entitled "Penggunaan Tempat Sampah Bermotif Terhadap Perilaku Buang Sampah Pada Tempatnya di Sekolah Dasar Negeri Wilayah Argomulyo, Sedayu, Bantul," April 2017 by Rashid Purnomo, Lucky Herawati, dan Choirul Amri in the journal Sanitation, Journal of Environmental Health. This article observes the lack of discipline of the children and the lack of waste management knowledge and demonstration. In this research, the solution to this problem is to provide a different pattern design by adjusting the type of waste. Observations state that there are internal and external factors relating to student intelligence. The inner element includes various levels of intelligence that each student has.
Some students read the directions on the regular trash can or observe the illustrations on the patterned containers, but some students do neither. External factors include the patterned design bin and the standard written instruction bin. The image on the patterned tray design is easy to understand and has a reinforcing element that becomes a student motivation factor. Research shows that individuals gain a better understanding of visual graphics rather than audio or reading [12]. The third articles title “3R (Reuse, Reduce, Recycle) Practices Among MOE Preschool Pupils Through the Environmental Education Curriculum”, 2016 by Hanifah Mahat, Mohamad Suhaily Yusri, and Che Ngah. This article observes that children's behavior follows adult behavior as an example of behavior. Children have no grasp of understanding the purpose of their action in waste management. Therefore, teachers need to help explain why children recognize the recycling symbol and learn to throw garbage into the correct trash. The children see and follow what other children are doing, create a chain of knowledge, and continue the 3R practice. As a result, waste management education and 3R practices are not implemented in the student's lifestyle. Another consequence is, schools must pay attention to improving the progress of 3R practices, and also, the 3R method must be more diverse, using manuals or other books and activities [13]. In article titled “The Psychological Impact of Infographics in Education,” by Huseyin Bicen and Mobina Beheshti (2017) study that the education format preference affects learning and teaching activities. The questionnaire's outcome says that more than 82% of the students agreed to use infographics regarding the educational method in learning, and an infographic can enhance their creativity, knowledge, imagination, motivation, and communication skills. It can also encourage them to learn new subjects. Visual literacy encourages students to learn more than textual information. Therefore, students prefer to study with infographics and eager to use infographics as their learning tool to develop their skills [14]. The last journal, entitled “Child Education through Animation: Experimental Studies,” published by the International Journal of Computer Graphics & Animation, 2014, combines multimedia and traditional learning called blended learning. This study uses an experimental method with multimedia and animation technology to assist conventional teaching methods. Animation encourages students to learn, especially for children aged five to six, to improve their cognitive abilities. Therefore, interaction design, such as interactive multimedia courseware with storytelling, makes children's learning more comfortable. As a result, students who are taught using the blending system can obtain much higher yields than other teaching methods [15].

Accordingly, the authors provide alternative solutions for making educational media illustrations in animations, exercise books, and infographic posters. This study will educate children using three learning approaches, namely visual, auditory, and kinetic approaches, to create attractive illustrations with attractive characters and colors. The story should be interesting and understandable so that children will process and remember the information better and have dynamic two-dimensional animation. This research is also useful for the young generation to understand waste management and form good habits for the Indonesian nation's future.

2. Methodology
Qualitative method research through in-depth interviews with some key informants is the elementary school headmaster, Gemala Ananda Elementary School grade one and grade two students, children psychologist, and the CEO and Co-creator Atlas Boy Adventure Animation. Interview data were used by authors to test the correctness of the hypothesis, to support alternative solutions for making educational media illustrations in animations, exercise books, and infographic posters. The interviews were held from February to March 2020, and all interviews were located in DKI Jakarta. This research will educate children using three learning approaches for visual, auditory, and kinetic processes. Another method in this research is to direct observation and analyze the Kids Academy, storytelling waste disposal youtube channel "Binogi," as a matrix and author's comparison in exploring and experimenting with content design, storyboards, and animation about waste management and waste separation. Furthermore, the discussion of interviews, observation, and analysis is discussed in detail as follows.
2.1 Interview with Gemala Ananda Elementary School Headmaster, on 10 February 2020
Authors chose Gemala Ananda Elementary School because the school has implemented waste separation. The school location is on Jl. Lebak Bulus III no. 93G, Cilandak, Jakarta, Indonesia 12440. The school provides separate waste and provides two different bins for each class: wet trash and another for dry trash. Schools classify waste based on the waste that the school produces. The teacher provides education about waste sorting and the importance of waste management through learning activities in the form of a PowerPoint application in images and text. For level one and two, students are only taught about sorting waste, and for level three are taught organic waste management, namely composting. In conclusion, concrete visuals can attract children to learn to sort waste.

2.2 Interview with Gemala Ananda Elementary School grade one and two students, on 17 February 2020
In the first grade, students know that they have to put the trash in the correct trash. If you bring snacks, you have to take the plastic packaging home. They also have a basic understanding of waste decomposition. For example, food waste will rot; the paper will eventually crumble while plastic takes 100 years to disintegrate. Students love to watch YouTube videos about littering lessons. They love characters like the Avengers and cute little kids and pets. In the second grade, students understand about solid waste and waste management. They explain the types of waste and how to manage it. Students love cartoons such as Mickey Mouse, King of the Apes, and Upin Ipin. They like unique characters who have superpowers. In conclusion, first and second graders like characters with cartoon film visuals.

2.3 Interview with Children Psychologist, thru Zoom Video Communication, on 17 March 2020
The purpose of the interview with a child psychologist named Mutiara Nathania, M.Psi is to determine which learning methods are effective and how the children understand the information provided. She stated that to shape children's character, a habit must be practiced from an early age. Children learn by listening and paying attention to what the environment is doing. If the habit is made every day, the child will get used to it. Second, children ages six to seven are at a stage where they want to try new skills and separating trash can be one of them. When a child gets a lot of stimulation and a lot of activity outside the academic class, in the end, the child will develop in a more positive direction. Third, varied learning styles such as visual, auditory, and kinetic. Learning-by-doing or learning-by-playing is also the right learning style. So, children can learn while having fun. Fourth, children aged six to seven have simple cognitive abilities. They can understand uncomplicated but straightforward words and many words. So when creating animation, it's better to have fewer words and more action, and for waste categories, it's better to have a few types as possible. So, two or three categories are better for children's cognitive abilities and waste separation. And finally, because it is still in the pre-operational stage, they need concrete information to understand it. Information should not be vague or symbolic. It should be to the point. This must also be applied in designing characters in animation. The character is better off being a person or something the kids are familiar with. As a result of this interview, all the information about effective learning methods makes it very important to determine what strategy and visual media the authors will create for this research topic.

2.4 Interview with CEO and Co-creator Atlas Boy Adventure, thru Zoom Video Communication, on 27 March 2020
The animated series on YouTube called Atlas Boy Adventure has the style that writers want to put into their projects. The authors interviewed the CEO and co-creator of Atlas Boy Adventure, Mrs. Astrid Sugandi. According to him, there are two forms of using animation for children's education: animated edutainment and narrative storytelling, which are very useful for children aged 6-7 years. In making animated information videos, there are several processes. The first step is to define the main idea and earn some core points. After the points are determined, the next step is to make a story from these points, followed by choosing the illustration style. Then after everything is collected, it finally
produces animation. When creating a storyline for the child to understand, it’s best to use related elements such as language or vocabulary that are generally understood by the child. Six and seven-year-olds have short attention spans and are less fluent in reading. So in making designs that use illustrations and text for an explanation, illustrations must be more dominant than text. The recommended length of videos for younger children depends on the platform. YouTube videos can be up to three minutes long, and media such as television can be up to five minutes. Insight from the interview allows the authors to create an animation that is appropriate and compatible for the target audience.

2.5 Youtube Channel “Kids Academy” Recycling for Children
 Youtube channel called “Kids Academy” made a video on December 22, 2018, about recycling for children. It has a duration of 3 minutes and 15 seconds. The storyline begins with two children, a girl, and a boy, depicted on a picnic and having lunch. When they wanted to throw it in the garbage, they realized that there were two types of waste: recycled and non-recycled. The recycle bin has a symbol of 3 arrows forming a triangle. Immediately they questioned what the symbol meant. Then there are garbage trucks and garbage men who come and explain the children’s questions about the symbols they see. However, the children still did not understand the meaning of recycling and kept asking questions. The man replied that recycling is turning old trash into something new. He also explained the types of waste that can be recycled, such as glass, aluminum cans, plastic, and paper, to tell the children to throw garbage in the correct trash. The children then asked the audience to help sort the waste. The video starts interacting with the audience, providing trash cans, and asking the audience which trash can has the trash can. The authors’ analysis in general and criticism for the youtube channel “Kids Academy” below is that the animations use simple stories and infographics. The character design for this animation is vector-based. The illustration uses organic and inorganic forms but mostly inorganic because it looks more rigid. The colors used are bright to distinguish between the main character and the trash can. Illustrations provide great detail, but smaller elements such as texture are not rendered. Animations are not created frame-by-frame because the movements are mostly rotations and positions.

![Figure 1. Recycling for Kids (Academy, 2018)](image)

2.6 Youtube Channel “Waste Disposal”
 A youtube channel named “Binogi” made a video on 15th August 2014 about waste, waste effects, and waste management. It has a duration of 2 minutes and 42 seconds. The story starts by explaining what waste and its categories are. It shows how to manage the waste, the boy character is seen in the middle, and the explanation is happening around him. The video then informs the categories of inorganic waste and tells that the wastes are picked up by the garbage truck. Then the video informs about how the wastes are affecting the environment negatively and how to prevent them. After giving all the
information, the video recaps all the data into a more detailed note, using bullet points. The authors' analysis for youtube titled "Waste Disposal" in figure 2 is, that the animation uses infographic style for their storytelling, has a lot of information in a less than 3-minute video. There is only one character, the boy, but he is not the main character that explains the story. The boy is used by the narrator to help the video in explaining. Design-wise, the illustration is vector based and uses color block and less-to-no textures. The colors used have a semi-dark tone, and there is no color difference between the wastes, which all are green. The animation is simple and mostly uses position and rotation. The ending does not give a specific solution; instead, it provides information and lets the audience use their moral compass based on their knowledge.

![Figure 2. Waste Disposal (Binogi, 2014)](image)

2.7 The Creative Process of making The Logo, The Characters, The Memo Book, and The Infographic Poster Design, and The Storyboard of The Animation

The mind-map and the mood board consists of illustrations that inspire a writer's style for all media designs. Simple shape designs inspire the selected illustrations. The simple design consists of color blocks, organic lines, and simple textures. The authors chose this illustration style because it is easy for children to understand and accentuate objects with color.

![Figure 3. Mind-map and mood board](image)

*Prajurit Alam* or Warrior of Nature is the name chosen. They also train every day and create disciplined schedules to achieve their goals. The ultimate goal of this program is to educate children to
protect the environment and nature. The font for this project uses Boogaloo Regular. This font features an organic yet clean design that's perfect for engaging young audiences and reading as well.

![Figure 4. Prajurit Alam logo sketches and after digitized as vector](image)

The colors represent the color of an organic and inorganic waste bin in Jakarta. Organic wastes are described with green and inorganic wastes are represented with orange and yellow. Complementary color creates a contrast and vibrant look to differentiate the types of waste. For organic waste, it will be represented by green and yellow. In comparison, inorganic waste will be represented by orange and blue.

![Figure 5. The color palette](image)

The main characters in the animation will represent organic, inorganic, and students. Since the project will use an Indonesian name, the character names will be in Indonesian. For organic representation, the character is a boy named Oni, derived from O (rga) ni (k). For Inorganic representation, the character is a girl named Anggi, derived from the word An (or) g (an) i (k). The child's shape and the character design are made simple and clear to be easy to remember by the target. The color is adjusted to the existing color palette.

![Figure 6. The main character progress design](image)
A set memo book and an infographic poster for educational tools for waste management. With the hope to educate children using animation and remind them of lessons using memo books for individual learning and infographic posters for classroom learning. Both design concepts are simple and straightforward to make it easy for the target audience to understand, using the same design nuances as animation design.

Figure 7. Memo book dan infographic poster sketches

The storyboard with the script of the animation titled “Introduction to waste management for first and second grade,” based on the essence of the story from the animation is the brainstorming in the form of story keywords starting from: what is waste, about waste in Indonesia, and continues with the problem of garbage in Jakarta, types of waste, waste management, and how to separate waste.

Figure 8. Some storyboard sketches with the script
3. Media Implementation
The communication strategy in this study is informative, easy to remember, and interactive. The information provided should be light enough so that the child can capture and store it. The rational approach to this project is to provide education through entertainment or edutainment. This edutainment takes the form of animation because the target market is first and second-grade elementary school students with a fun and attractive design so that children feel happy, curious, and active in learning new information. Character voices are very important for children who are learning auditory, where a cheerful voice will make them happy and entertained. The storyboard in the animation will inform the audience about the meaning of waste and its impact and then provide a solution by sorting the waste. To ensure that the audiences remember the information, infographic posters will be offered to schools and the memo books for each child to read and practice their knowledge of sorting waste. This project is expected to educate about waste sorting at an early age and contribute to the hygiene, health, and safety of the Indonesian people in the next step.

3.1 The Final Logo Prajurit Alam
The final logo combines a soldier helmet and a plant sprout, and it represents growth. It also means small things can lead to significant change. It is combining a soldier helmet and a sprout. Prajurit or Soldier, who always practice using the five senses, including visual and auditory. They also train every day and created a disciplined schedule to achieve their goal. It is like the program where they encourage the children to do small things to achieve more significant goods using their sensory and skills. Alam or Nature: The program's end goal is to educate children to protect the environment or nature.

![Figure 9. The final logo](image)

3.2 The Final Animation
The final video animation titled is “Introduction to waste management for first and second grade,” with duration of 3 minutes 56 seconds. The storyline follows from the processed and determined storyboard and script. The software used is from Adobe Illustrator for vector-based, Adobe Photoshop for coloring images, and Adobe After Effects for creating motion graphics and effects on animation.
3.3 The Memo Book and Infographics Poster Design

The Memo Book and Infographics Poster Design were made vector-based in Adobe Illustrator, based on concepts that have been processed and determined in the final sketch on the storyboard.

![Figure 10. The final animation scenes](image)

![Figure 11. The cover, the inside, and the back cover of memo book](image)
4. Conclusions
Using animation can improve a child's ability to focus and receive messages because they are excited. To remember messages, an exercise book can help them. The authors hopes to educate children using animation and remind them of lessons using memo books for individual learning and infographic posters for classroom learning. The authors recommends educating children about waste sorting and waste management using fun educational tools with colorful illustrations and interactive designs. Although media design in animation, memo books, and infographic were implemented for this exploration, no validity can guarantee that this research is significant, and further research is still needed.

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