Design of Joyful Trash Box

Learning Media for Early Childhood Environmental Education

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Abstract—**Environmental hygiene education is one of the way to improve the quality of life. Such education should be taught from early childhood, because this age is the beginning of the character and personality forming. This study aims to develop trash box design as learning media to raise children's awareness, behaviors, and habits to keep trash in its place. Research and development was conducted start with survey using questionnaires and in-depth interviews. Trash box product design development was analyzed with QFD. Joyful trash box designed is audio-visual learning media for pre-school children. The advantages of that product as follows safe for children, attractive design, easy to use, sensitive to touch, and have attractive learning using photoelectric sensor and reflector.**

Keywords—trash, environmental education, product design, QFD

I. INTRODUCTION

Environment hygiene is one of the factor to improve the quality of children's life. Irony, many people who indifferent and tend to ignore, especially in terms of disposing of trash in trash box. Even, the amount of trash in Indonesia is predicted to reach up to 130,000 tonnes / day in 2025 [7]. If the trash was unmanaged properly, it would affect the children and the environment negatively, and it causes [2]: (a) interfere to sight and comfort; (b) lead to disasters such as floods, landslides, accidents, etc; (c) cause disease; and (d) affect to the social, economic and cultural. Nevertheless, the survey on 2013 showed that 77% of Indonesian children have a concern for the environment [9]. This value indicates a higher awareness compared to children in the US (66%) and the UK (58%) [9]. Kepedulian anak dapat ditingkatkan dengan memasukkan pendidikan berwawasan lingkungan sejak usia dini, dimulai dengan cara membuang sampah. Children awareness can be improved by incorporating environmental education from an early age, starting with how to dispose of trash.

The purpose of environmental education for early childhood is to build childre's character, personality, awareness, and habit to love their environment [11]. Learning media used to optimize the learning process [16]. Trash can be designed as a learning media for environmental education.

The purpose of this study is to develop educative "trash box" product design for pre-school children to enhance awareness, attitude, and habits to keep trash on its place. The trash box is expected to be an attractive and fun learning with environment concept.

II. LITERATURE REVIEW

A. Early Childhood Environmental Education

According to Asef Umar Fakhrudin in Livianti et al [8], early child needs educational efforts to achieve all perfection aspects optimally, both physical and psychological perfection, i.e. cognitive, art, linguistic, motoric, and socio-emotional. Regulation no. 20 chapter 1 clause 14 in 2003 declares that Early Childhood Education (ECD) is a development effort directed to children since birth to six years age, which is carried by provides stimulation of education to assist children's growth and development both physically and spiritually, so that children have preparedness to continue further education [5]. It is the golden age, which is crucial age in the intellectual development, also character and personality building. If the parents give incorrect stimulation, it will affect in adulthood.

ECD carried out through formal and informal education. Configuration of formal education are Kindergarten, Raudlatul adfal (RA), or other equivalent forms. Informal lanes implemented through playgroup, daycare and other unit education [10]. Educating children by instilling a love for lifelong learning, creativity, self-expression, and an appreciation for diversity [4]. Basically, the purpose of education is to take the students on positive behavioral changes in intellectual, moral, and social [16].

1) Environmental Education

Regulation No. 32 Chapter 65 point 4 of 2009 regarding Environmental Protection and Management, mentioned that everyone has the right and plays a role in environmental management. It means each individual must have a sense of responsibility towards the environment. Schools are expected to participate and take part in embeding environmental awareness to the young generation early on. Sumarmi (2008), quoted from Afandi [1] states "environmental foundation instilled since early stage will be main solution to do, in order to young generation have an understanding on environment properly."

Education is a tool to provide community's knowledge, skill, and attitude in order to care and sensive with environmental issues. Environmental education was marked by cooperation and agreements between Ministry of Environment and Ministry of Education. The agreement was authorized with the signing of MoU on

June 3rd, 2005, and implementation Adiwiyata Programme on 2006 [1].

Nowadays, many schools lead to school-based environment using natural and contextual learning model. In addition, all facilities and infrastructer which exist in the environment used to learning resources [4]. Moreover, teachers have an important role in education, though the learning process can be carried out properly. According to Edi Suardi in Livianti et al [8], the theacher's roles in educational interaction as follows: (a) the instructor; (b) the supervisor; (c) the facilitator; (d) the evaluator; and (e) the motivator.

2) Learning Media for Children

The early childhood stimulation was conducted through playing activities, or learning by playing. A fun learning process is supported by the media in the form of interesting and fun props, according to the characteristics of child development [10]. Learning media has an important role to increase children's motivation and effective learning process. In accordance with Sugiharto [10], learning media is an object or tool used by educators to clarify and simplify the learning process for students.

Learning media can be classified into 3 types, those are visual, audio, and audio-visual media. Visual media consists of projected and non-projected visual. Projected visual can be formed by still pictures and motion pictures. Non-projected visual consists of pictures, graphic, model and real media. Whilst, audio media contains message in auditive form that can stimulate children's thoughts, feelings, concerns, and desire to learn the contents, for examples sound cassettes and radio programs. Audio-visual media is a combination of audio and visual media in order to present the content more complete and optimal [16].

The benefits of learning media for ECD as follows: (a) to communicate the information more clearly, interesting, and concrete [12][13][16]; (b) to overcome the limitations of space, time, and power senses [12][16]; (c) to increase students liveliness in learning; (d) to build motivation and passion in learning [16]; (e) to enable direct interaction between students with the real environment [13][16]; (f) to direct student learning on their own according to their interest and ability [13][16]; (g) to give same stimulant, experience, and perception [16].

B. Product Design based on QFD

Ulrich et al [15] explained that product development process consist of planning, concept development, systematic design, detail design, testing and improvement, and first production. So, the design is a complex and expensive, that involves both internal company functions (from marketing to manufacturing) and external resources (from consultants to suppliers) [6].

Technological and economic–organizational views are the dimensions about which design-supporting tools may find a proper classification and an adequate validation. A short description of techniques and supporting tools grouped into specific macroareas, corresponding to well-defined steps of the design process, follows. Within any macroarea, we define some specific classes to offer a sufficiently clear reference framework. The first macroarea is about new design start-up and refers to market studies and Quality Function Deployment (QFD) [6].

QFD is a functional planning tool used to ensure that the voice of the customer is deployed throughout the product planning and design steps [3][6]. Data are collected by means of interviews, questionnaires, and comparisons with the competition and marketing channels. The importance of QFD as a tool stems from the fact that both the customer and the company are compelled to make the effort to organize the project in compliance with the instructions set down in the proffered forms [Franc]. There are four forms in QFD, as follows product planning matrix; part deployment matrix; process planning matrix; process and quality control matrix [Fran].

The first matrix to be used in QFD is known as the house of quality (HoQ). HoQ of the product planning matrix compares the customer's foremost requirements (*user requirements*) with product characteristics (*product attributes*), which are the technical requisites needed to render product specifications coherent with customer expectations. The matrix thus obtained defines the relationships occurring between the two elements and their reciprocal priorities. Furthermore, it enables the user to develop comparisons between product characteristics and the best available competitor performances found on the market (*benchmarking*)[6].

The list of HoQ principal phases includes [3][6][14]:

- Identifying customer requirements
- Identifying product and engineering design requirements
- Drawing up a relationship matrix
- Planning and deploying expected quality (by listing customer requirements in order of importance and benchmarking competitive products)
- Comparing technical characteristics (through a technical importance ranking)
- Analyzing the correlations existing between the various characteristics (correlation matrix)

III. RESEARCH METHOD

Research and development (R&D) was conducted, start with a survey to determine the customer requirements for trash box as learning media for early childhood. Then, technical spesification and design developed by its interpretation. This study uses purposive sampling technique, which uses subjective consideration in order to select respondent. Respondents are people who work as teachers or childhood educators, and parents. Data taken using questionnaires and in-depth interviews, then we made product planning matrix according to the stages of QFD. Further analysis and discussion is needed to develop the design of educational trash for early childhood.

IV. RESEARCH FINDING

A. House of Quality Design

Based on voice of customers (VoC), the most important aspect towards to children is a trash materials with value of 10.7%. Whichever, fiberglass materials are safer and lighter than iron, and it is not corroded easily. The second priority of trash box design with 10.6% is educators expected that the product able to motivate children to keep trash into its place and to enhance children awareness to their environment. In order to maintain children's health and not cause to odor, the trash box supposed to clean easier with value 10.4%. Attractive design and secure shape have a similar value is 10.3%. Educators expect to trash box shape is safe, which is no sharp parts that could danger toward children. While an attractive design could be trigger children's curiosity and interest in learning. Further, fun learning has a relative importance at 10.2%, where children can gain knowledge about the trash and the environment. Colors give a percentage of 10% for trash box design, which children love colorful and flashy color. In addition, affordable prices gets value of 9.6%, and durable of product with 9.2%. The most unimportant aspect according to educators is the ability of trash box as learning media to accomodate lot of trash, with score 8.5%. Designing of HOQ as concise interpretation of a consumer standpoint, assumptions and decisions of researchers, can be seen in Figure 1.

Technical specifications composed from VoC and logical interpretation of designer, the importance based on sequence largest to smallest i.e. trash box design (18.3%), materials (17.5%), educative audio (14.5%), dimension (13.8%), shape (13.6%), color composition (8.3%), top (7.4%), and sensitivity to touch (6.8%). Trash box design should be designed interesting up for children. For example by giving the image preferred by children, such as cartoon characters, or animals, or fruits and vegetables, or scenery, or other things related. The material used should be safe, easy to clean, not corroded, lightweight, and the paint is not easy to peel. Hence, the trash box will be used to learning media, the educative audio concerned environment should be inserted the trash box. In addition, the dimesion should be designed with medium size, for its volume and height. So, it's able to accomodate trash and to have fit height to children ergonomically. The trash box designed toward secure shape, it has no sharp part in the box. The color composed fitted with the design, and should be attractive to catch children's attention. Moreover, the top of the trash will be made with safety design and easy to open. Lowest percentage of technical spesification is sensor added to respond children's touch.

In addition, HOQ also set with existing product comparison on the market. Product competitor divided into 3 types. Futhermore, new products developed must have a comparative and competitive advantages adjusted consumer needs.

B. Design of Educational Trash Box

"Joyful Trash Box" is the name of product, which are designed and used to learning media for children. Market share of this products are toodler (early child) / preschool (4-6 years) educators. The goals of product development as follows: (1) to aware children of their environment sanitary; (2) to motivate children to keep trash on trash box; (3) to develop joyful learning for children; and (4) to enhance children's emphaty. Materials that be used are fiberglass trash box, acrylic paint, micro-controller, Information Storage Device (ISD). The fitures are sound modal, switching adaptor, object sensors, and paint brush. Product design can be seen in Figure 2.

Figure 2. Design of Joyful Trash Box

The advantages of this product consist of:

- Safe for Children. The trash box made from fiberglass material which safe for children. It is lightweight, and is not easily corroded. The trash box painted with accrylic paint. Top design does not harm for children, where they do not need to open the top.

- Attractive Design. The joyful trash box design uses attractive picture with animals theme that loved by children. It can interesting children to know about trash box

- Easy to Use. Children able to open trash box easily by moving top

- Sensitivity to Touch. When the children touch or open the top, the trash will release attractive sound automatically, caused by photoelectric sensor and reflector fitures

- Attractive Learning. The sound as audio learning able to raise children's awareness and habits. This audio involves: (a) the sound of animals, according to the theme; (b) children's songs about the environment; and (c) gratirude-note as appreciation to children

Figure 1. Product Planning Matrix of Joyful Trash Box

V. CONCLUSION

Joyful trash box is learning media with audio-visual type. It provides real model of trash that can give direct experience to children's learning of environmental content. Futhermore, the media also gives audio learning that contains of animal's sound, and song about taking out the trash, and acknowledgement to children who had been throwing trash in its place. This media will be an interactive learning for children, and increase positive attitudes of children in throwing trash. Moreover, the media can replace the teacher's role within certain boundaries. Teachers not always act as a subject presenter, but turned into a facilitator. Design trash still needs to be evaluated whether these designs are appropriate to educators and children's requirement. Further, feasibility studies necessary for mass production.

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