Building environmental awareness for future generation through educational comic: the story of 4th-grade students Darussalam elementary school, Panongan, Tangerang

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Abstract. In the past 20 years, our deteriorating environment has become a global problem. Sustainable development has become our goals for a better future. In its SDG’s 2015-2030, the United Nation has shown that people and the continuity of the environment are integral. Sustainability means that it would provide for the recent generation necessities, without risking the needs of future generations. The research focus is building environmental awareness for the 4th-grade students of Darussalam Elementary School, Panongan Regency, Tangerang. The propose strategy is by inserting educational comic through their formal Environment Education subject. It is develop through active engagement with the students as well as the teacher at Darussalam school environment using Participatory Action Research combine with Design Thinking methods. The result will be an educational comic that promotes environmental awareness that is connected to the school physical and learning environment. In the same time the comic will sparks the children’s imagination and ask them to put their knowledge from the book into action. This strategy of correlate people (the children), place (identity) and use (knowledge and action) is deemed effective in building sustainable environmental awareness for the future generation and has the potential to replicate nationwide.

1. Introduction
In the past 20 years, our deteriorating environment has become a global problem. Sustainable development has become our goals for a better future. In the United Nations’ Sustainable Development Goals 2015 -2030, the people and the continuity of the environment are integral. Sustainability means that it would provide for the recent generation necessities, without risking the needs of future generations [1]. One of the sustainable development goals is to make cities and human settlements inclusive, safe, resilient, and sustainable (SDG 11) [2].

Inspired by SDGs 2015 - 2030, the research then tried to focus on how to build sustainable environmental awareness for the future generations. Thus, it means for the children. It will be test in a small scale, with Darussalam 4th-grade elementary school students in Panongan regency, Tangerang. The propose strategy is by inserting educational comic through their formal Environment Education subject [3]. It is develop through active engagement with the students as well as the teacher at Darussalam school environment using an approach of participatory design [4]. The result would be an educational comic that promotes environmental awareness that is connected to the school physical and learning environment. In the same time the comic will sparks the children’s imagination and knowledge
from the book into action. This strategy is deemed effective in building sustainable environmental awareness for the future generation and has the potential to be replicated nationwide.

The research-design-action was conducted approximately eight months by the students and lecturer from Visual Communication Design and Interior Design, School of Design, Universitas Pelita Harapan, Karawaci, Tangerang. The team engaged collaboratively with Darussalam, 4th-grade elementary school students. It is a demonstration on how design could empower and transform people by making social innovation and has a redemptive impact towards others and the environment [5].

2. Method
The research-design-action activities conducted in this paper are using research methods and action - implementation tools as follow:

- To produce participatory design intervention for Darussalam 4th-grade elementary school students [4], the research used a specific methodology called Design as Generator (DAG) [6]. It combines Participatory Action Research (PAR) [7],[8],[9] with Design Thinking [10],[11],[12] methods. The combination will allow research-design-action activities to be done simultaneously by the team collaborating actively with all the stakeholders [13].
- Cultural mapping method was used to correlate and examine the data gathers from the key stakeholder (the children), the place context (identity), and the utilization of knowledge towards action [14].
- Impact of the design interventions then measured by a simplified pre-test and post-test [15], [16] conducted with the main stakeholder, which are the students of 4B (Al-Latief), Darussalam elementary school.

3. Results and discussions

3.1. Darussalam School, Panongan Regency, Tangerang: 4th-grade elementary students, 4B (Al Latief)
The aim of sustainable development in 2015 – 2030 is to transform the earth and the lives in it by connecting people, planet, prosperity, peace, and collaborative partnership [1]. To achieve the high goals that the SDGs has set, it is fundamentally essential to raise and build the awareness of having sustainable, cities, settlements and environment for the future generation, the children.

Thus this is the position of the research, in its minuscule scale the research-design-action activities aimed at raising and building sustainable environmental awareness to the 4th-grade students of Darussalam elementary school, primarily through providing and taking care of greenery area in their school and settlements surrounding area. The team, consisting of lecturer and students from Visual Communication Design and Interior Design, School of Design, Universitas Pelita Harapan, Karawaci, Tangerang collaborated with Darussalam elementary school stakeholders: the founder, teachers, and especially students from 4B (Al-Latief class). The collaboration is also done with Design as Generator (DAG) community as facilitator and methodology provider. It also collaborate with other local initiators that is already there in Panongan regency, such as literature community, and 3R (reduce, reuse, recycle) community.

![Figure 1](image-url)
Darussalam School consists of elementary, junior high, and senior high school. The school itself has the vision to generate sustainable environment awareness to its students throughout many initiations. One of the initiatives is to oblige everyone in the school to reduce or avoiding plastic use. For instance, the school canteen provides snacks without plastic containers or packages and the students are asked to bring their food container and drinking bottle. The school is also giving greenery area for each level of the students (elementary, junior and senior high). Besides that, the school is also adopting a national curriculum that has a section on environmental education for the students.

Thus the research-design-action activities conducted by the team was aimed on supporting the vision and programs of Darussalam school that has concerns on building sustainable environmental awareness to its students. In particular, the activities will support the environmental education curriculum for 4th-grade elementary students of Darussalam school, especially students from 4B (Al-Latief class).

3.2. Participatory action research – design thinking phase: research-design-action

The research-design-action activities are conduct as follow:

3.2.1. Data gathering activities were direct in a model of Participatory Action Research (PAR) and Design Thinking (DT) Discover-Look phase [7],[8],[9],[10],[11],[12]:

- **Community engagement:** The team should engage with at least eight members of Darussalam elementary school. It consists of the principal of Darussalam elementary and junior high school, the teacher assigned for 4A and 4B, several elementary teachers and four 4B students. The engagement showed that Darussalam School is indeed giving extra attention to raising and building sustainable environmental awareness to the students through many initiatives. It is also demonstrated that they have an ecological education subject in the curriculum.

![Figure 2. Diskusi dengan siswa dan Guru 4B.](image-url)

One of the initiatives that the students remembered was gardening activities. The children were passionate about the activities and even claimed that it was becoming their habits and also they brought the insights back to their home. The problem lies with the maintenance and sustainability after doing the gardening activities. The other problem is that there was a lack of innovative ideas and interactive learning approach that would make the ideas of greenery becomes a sustainable action. It also resulted in the ineffectiveness of raising and building sustainable environmental awareness to the children.

- **Talk to experts:** the team talked to experts that can give insights on how to reach the research aim in building environmental awareness to children. The team consulted with psychology lecturer on how to make movement sustainable. The team also consulted experts on greenery and permaculture on what should be consider in making lasting greenery. Lastly, the team referred to education lecturer on how makes learning and its environment becoming fun and...
interactive. From the latter, the team learned about using comic as effective learning media, especially in knowledge absorption efficiency [3].

- **Immerse in context**, is where the team should immerse in the similar and contextual situation with the problem faced. The team engaged with a commercial and tourist attraction farmland, where the visitors can interact by picking up vegetables and fruits from the farm. The team also learned from green kampong in south Jakarta to gain insights on how to make community movement and how to make it sustainable. **Analogous research** is where the team gained some insights from something different from the problems faced but can give valuable insights. The team investigated on-line mobile game that asked the player to take care of a farm. The team found out that difficulties in each stage, the feeling of taking responsibility and successfully making more harvesting are what make the game played by millions of people.

3.2.2. All of the data and insights gathered then formulated by the team to become significant themes, concepts, and later on to become problem statement. This phase in PAR-DT is known as Ideate-Think phase [7],[8],[9],[10],[11],[12], where the result will come up as ‘How Might We...?’ (HMW) Question. Themes found by the team are: (a) Students’ lack of concern when it comes to maintaining the greenery that already initiated. (b) The needs of interactive and innovative ways of learning in sustainable environment education subject for students. The problem statement formulated from it is: ‘How might we raise the enthusiasm of Darussalam 4th-grade students to do greenery action in its whole process with interactive and innovative ways of learning? The process will consists of planting, maintaining until producing (if its productive plants) in their school and home surrounding area.

3.2.3. With the HMW formulated the team then proposing solutions and gather feedback from the stakeholders, especially the teacher and the students of 4B Darussalam elementary school by making a prototype. This phase is known as Prototype-Act phase in PAR-DT methods [7],[8],[9],[10],[11],[12]. The prototype offered as a solution by the team is an educational comic on the environment that based its learning material from the Environmental Education learning subjects from the school and national curriculum. The comic was picked as an effective learning media because it has high rates of successful and efficient knowledge absorption for the children and even for the adults. It is mostly because of the relaxing and imaginative notions emerged when someone read a comic book [3]. The comic would use Darussalam school existing buildings and environment as backgrounds, and students from 4th-grade Darussalam elementary school as the main character. These strategies opted as the translation from cultural mapping [14] that correlate people, place, and use. It would correlate the main character derived from 4th-grader Darussalam elementary school (people), Darussalam school environment (place) that would build the local identity; and the practical use of the comic that would fill with important piece of information on a sustainable environment. The comic would also ask the students implementing their knowledge through doing greenery and gardening action, comprehensively from planting, maintaining, and harvesting activities.

![Figure 3. Prototyping phase.](image_url)
The team then pilot tested the comic to the 4B (Al-Latief) class students to use and learn from the cartoon when it comes to Environment Education subject. The team also inducted interactive gardening game activities, where the students were asked to compete by doing simple planting activities using the comic book. These strategies aimed on producing sustainable environment knowledge amongst the students and raise their awareness in conserving the natural environment.

![Figure 4. The Educational Comic: Penghijauan Untuk Panongan-Ku and the interactive activities.](image)

3.3. Pre-Test and Post-Test: Measuring the impact

During the making of the prototype and the design interventions, the team conducted pre-test and post-test measurement to the students [15],[16]. The tests were meant to measure the impact of the educational comic, especially in the students understanding of the sustainable environment through greenery initiatives. It comes in the form of a questionnaire below that was distributed to the students before and after the students read the educational comic book:

- Do you have any idea of what greenery means? If you answer: yes please explain why.
- If you can answer the question no.1, did you ever do greenery?
- Did you ever do planting?
- If yes, what type of plants?
- Do you know the use of greenery and panting activities?
- If you answer yes, can you explain what the purpose of those activities is?
- If there are no plants in your surrounding area (your school and home), what do you think will happen? (Write down at least three things that will occur).
- Can you name the plants in your school? Do you know the use of those plants?

The results are showed in table 1 below
The table showed that there are significant improvements in knowledge amongst the students after they learned using the educational comic and doing interactive greenery games activities embedded within the comic. In the scale of 0-15 (points generated considering the value of the questions asked), it can be seen that the students most significant improvement in their understanding on greenery and planting activities. It is also in the way of action (13.7 points from 0 point). Other significant knowledge improvements are about types of plants (13.7 points from 1.2 points) and its usage (10.3 points from 1.96 points). The students also showed knowledge improvement on the negative impact of having an environment that has no greenery and plants (14.3 points from 5 points). The planting competition is also a success proof as an action implementation generated from the educational comic book. The students were experiencing the whole comprehensive cycle of planting, maintaining, and producing with great enthusiasm. It is shown by 100% participation by the students until the end of the competition.

4. Conclusions
The research-design-action team acknowledged that the scale of the research is minuscule, and there are a lot of inquiries emerge needed to test more. Nevertheless, the results of these activities undoubtedly had showed how educational comic and interactive-innovative learning are effective in producing the importance of greenery knowledge and raising sustainable environment awareness. The strategy is proven by the improvement of knowledge and awareness of the 4th-grade elementary students in Darussalam School in a concise time. Thus, the strategies are deemed effective on building sustainable environmental awareness for the future generation and have the potential to be replicated nationwide.

In a more optimistic tone, combining the production of knowledge and action in an interactive media such as comic book are seen as a good strategy. It became best when the comic book correlates people,
place and use contextually. Thus, it will generate sense of belonging and local identity amongst its stakeholders depicted in the comic book. Eventually it will be a very useful and efficient ways of producing and raising knowledge and awareness of sustainable environment that also lead to concrete action.

![Figure 6. The team with 4th-grade students and lecturer of Darussalam elementary school.](image)

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