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Promoting an environmental education project: the eco-picture diary in Yokohama City, Japan

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ABSTRACT

In recent years, Yokohama City, Japan, has seen substantial efforts to address socio-environmental issues. One such effort is the G-30 program, which has helped reduce garbage waste production by 43 percent in 2010, since 2001. The eco-picture diary, an environmental education project, has been identified as contributing to the success of G-30. However, no research to date has examined the diary's effect on garbage reduction, nor accounted for what the project is and how it became prevalent. Using questionnaires with citizens and interviews with other stakeholders, this case study addresses these gaps. Key findings concern how people perceived the diary to have been central to garbage reduction by citizens. The study also shows how the diary illustrates an example of backcasting, ecopedagogy, reflective learning, and place-based approaches to environmental education, as well as how uptake of the project can be explained via diffusion of innovation theory and the theory of planned behavior.

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Introduction

It is widely assumed that Environmental Education (EE) and Education for Sustainable Development (ESD) both play an important role in achieving the Sustainable Development Goals (SDGs), a set of seventeen goals from the United Nations with 169 targets for the international community to achieve a shared vision of development (Fisher and Fukuda-Parr 2019). These goals are especially important for Yokohama City, Japan, which has been designated a SDGs Future City by the Japanese government and an Eco2 City model case by the World Bank.¹

As a major city near Tokyo, Yokohama has developed rapidly since industrialization. Its population was 3.75 million in 2019; on other words its citizens have quadrupled in number over the course of the last seventy years (Higashide 2019). With fast population growth and urban development, the city's environment has degraded dramatically over the last century; this has included its garbage dumpsites being filled around the turn of the 2000s. To address this issue, the municipal authorities initiated the G-30 [Garbage –30%] program in 2003. The program was designed to reduce overall garbage waste production by 30 percent in 2010 (1.13 million tons), as compared to what was produced in 2001 (1.61 million tons), by sorting waste into fifteen different categories to recycle, reduce, and reuse (3Rs).

The city reported it managed to reduce garbage waste production by 43 percent during this period. An EE project known as the eco-picture diary, introduced by Recycle Design, a Yokohama-based civil society organization, has been identified as greatly contributing to the success of the program and the subsequent eco-initiatives (Yokohama City 2020). However, few works of existing literature have discussed the eco-picture diary project. To address this research gap, this study examines the possible effect of the eco-picture diary project on garbage reduction, and explores how it became widely adopted and accepted. Using a case study approach, we consider how EE tools such as the eco-picture diary may help promote eco-policies designed to address socio-environmental issues, through partnerships between informal and formal education providers.

The article is structured as follows. To begin, we sketch the theoretical orientation and framework for the case study. Next, Yokohama's eco-picture diary is described, with an elaboration of the statistics (e.g. changes in the uptake of the project) and its key characteristics, namely: a backcasting approach, reflective journaling, eco-pedagogy, and place-based education, based on the existing literature. Following this, the research design is explained and results are discussed. Finally, suggestions are made regarding the theoretical and practical implications and application of the project in other contexts.

Theoretical orientation and framework

In this article, given the context of Recycle Design, and the way they work, we use a diffusion of innovation theory (Rogers 2003) and a theory of planned behaviour (Ajzen 1991) as theoretical bases and social marketing as a strategic framework. In brief:

Heimlich and Ardoin (2008) note that Rogers' (2003) diffusion of innovation theory is useful for understanding the success or otherwise of non-mandatory EE programs, as it identifies and captures different motivations to adopt a behavior typically originating from a program of EE or issue arising from outside the school. In general terms, the theory seeks to account for how, why, and at what rate a new innovation becomes popular, including beyond its original context. In contemporary terms, it can be used to understanding why something has gone 'viral' or not, when there is no compulsion to adopt the innovation, e.g. in this instance, a law or policy for EE.

For Rogers (2003), diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. Key concepts in this theory include *innovation*, *communication channels*, *time*, and the *social system*.

Innovation implies a new idea or behavior (e.g. adoption of the eco-picture diary project). Whether an idea or a behavior is objectively new is not important. "If an idea seems new to an individual, it is an innovation" (Rogers 2003, 12). According to diffusion of innovation theory, innovations that are perceived to have *greater relative advantage*, *compatibility*, *trialability*, *observability* and *less complexity*, are adopted more rapidly than other innovations (Rogers 2003). *Relative advantage* refers to an innovation's perceived benefit as compared to existing tools or procedures. *Compatibility* is an innovation's perceived consistency with the existing values. *Complexity* is an innovation's level of difficulty to understand and use. *Trialability* is an innovation's ease regarding experimentation. *Observability* is an innovation's impact visibility.

Communication channels are the means of delivering messages among individuals. *Interpersonal channels*, such as social networks, are often seen to be more effective than *impersonal channels* (e.g. broadcasting) in persuading an individual to accept a new idea or behavior because most individuals, "depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves" (Rogers 2003, 18-19).

Time is an important dimension in the innovation-decision process, as the passage of time is necessary for innovations to be adopted, and that may include after some modification to the

original idea (Rogers 2003). According to the theory, diffusion typically takes place in a chronological sequence that involves the following:

1. *awareness/knowledge* (one becomes aware and seeks knowledge concerning the proposed behavior);
2. *persuasion* (one adopts positive attitudes toward the proposed behavior);
3. *decision* (one forms the intention to practice the proposed behavior); and
4. *confirmation/continuation* (one performs the behavior and continues it).

Diffusion occurs within a **social system**: “a set of interrelated units that are engaged in problem solving to accomplish a common goal” (Rogers 2003, 23). The system’s structure has an impact on diffusion by giving *regularity* and *stability* to human behavior within a system. In this context, *social norms* will likely affect the rate of adoption of new innovations as they influence the behavior of individuals.

Diffusion of innovation theory shares some characteristics with the various theories of reasoned action (TRA) and planned behavior (TPB) proposed by Ajzen and Fishbein (1980) and Ajzen (1991). TRA assumes that *attitude* and *subjective norms* create the *intention* toward *adopting a given behavior*. *Attitudes* comprise personal values, beliefs, and concerns as well as awareness and knowledge. *Subjective norms* comprise descriptive norms (what those who are important to one do) and injunctive or social norms (what should be done) (Ham, Stanić, and Freimann 2015). To better *predict behavior*, perceived behavioral control has been added to TRA and developed into TPB. *Perceived behavioral control* is a combination of *perceived self-efficacy* (one’s perceived ability to execute control) and *locus of control* (how much control individuals think they have) (Ajzen 1991). A high level of perceived behavioral control should ideally strengthen people’s intention to adopt a behavior, and increase their effort toward it.

Diffusion theory and/or TPB are useful theories for *social marketing* (David and Rundle-Thiele 2018; Sundstrom 2014). Social marketing aims at *voluntary behavior change* (Rundle-Thiele 2015) and can be applied to encourage pro-environmental behavior, including via nonformal or informal EE (Gregory-Smith et al. 2015; McKenzie-Mohr 2011). According to Da Silva and Mazzon (2016), social marketing comprises three different levels of actions: (1) assessing the social problem, (2) influencing social change within the target population, and (3) formulating a social marketing mix. In the case of Yokohama City, Recycle Design had to analyze the socio-environmental issues first, and then identify the desired social change within the target population. The social marketing mix is formulated through the 4Ps or 4Cs: *product/customer*; *price/cost*; *place/channel*; and *promotion/communication*.

Product/Customer: Eco-picture diaries are tangible products, while pro-environmental behavior is an intangible product adopted by customers (e.g. students, teachers, family members, and other citizens). Neiger et al. (2003) explain that a notable feature of the social marketing approach is a persistent focus on treating citizens as customers.

Price/Cost: Price consideration relates to ‘exchange theory’ (e.g. giving up a behavior in exchange for a new behavior). Closely related to the concept of exchange is positioning (Neiger et al. 2003). In social marketing terms, positioning is the process of popularizing a product in contrast to existing competition (Madill and Abele 2007).

Place/Channel: Place refers to the distribution channels of services or delivery of goods. In a social marketing context, place often implies the location of services that have been put in place to facilitate adoption of a new behavior.

Promotion/Communication: Promotion is often equated with communication strategies, which are important to informing target audiences about how the behavioral change will benefit them (Da Silva and Mazzon 2016). (The aforementioned diffusion of innovation theory can be considered to be a type of communication theory, Rogers 2003).

The focus of social marketing has shifted from individual behavioral change (downstream) to institutional and organizational change (upstream) (Truong, Saunders, and Dong 2019), including in ESD in Japan (e.g. Mochizuki 2017). However, we note upstream social marketing approaches may be ineffective if used independently (Brennan and Binney 2008, 267). Cherrier and Gurrieri (2014) state the importance of broader social marketing frameworks that involve both downstream and upstream perspectives. Furthermore, to realize systemic social transformation, macro-social marketing approaches may be required (Phdungsilp 2011; Truong, Saunders, and Dong 2019; Vergragt and Quist 2011). While micro-level social marketing includes individual behaviors, similar to downstream social marketing, macro-social marketing goes beyond mere upstream social marketing, and seeks systemic social change, including through education (Brennan and Binney 2008; Kennedy 2016).

Yokohama's eco-picture diary

The eco-picture diary is an eco-project as well as an instructional tool used in EE. The purpose of creating the diary is to inform students, their family members, and other citizens about particular socio-environmental issues and strategies that can address these issues, such as promoting 3Rs, reducing greenhouse gas (GHG) emissions, and working towards one or more SDG targets.

Recycle Designs' eco-picture diaries were introduced in 2000, with the slogan, "Children's ideas to transform world systems." The organization works closely with schools to implement the project in the initial stages, introducing the eco-picture diary and how it can be used in the school, and elsewhere. Recycle Design also works toward developing connections among schools, private businesses, and other stakeholders.

In practice, within an eco-picture diary, students are instructed to write and draw how they want their city to be in future and what they can do to realize this ideal future. This includes discussions with family members about socio-environmental issues as well as elaborating on and expressing strategies to address these issues (Recycle Design 2019). Many private companies also encourage their employees to participate in evaluating the contents of the eco-picture diaries, and in the award ceremonies for participation in the eco-picture diaries. Through occasions such as exhibitions, other members of the public also have an opportunity to consider the students' diaries (Recycle Design 2019).

Application forms to participate in the program are distributed within all elementary schools in Yokohama at the end of June. If teachers agree to participate in the project, their students are asked to prepare the diaries as a part of the homework during the summer break. The completed eco-picture diaries are evaluated by stakeholders who are selected as evaluators during the annual citizen selection meeting. Evaluated diaries are returned to the schools at the beginning of September. The diaries that are evaluated highly are exhibited at various places, such as events hosted by the Japan International Cooperation Agency (JICA), Yokohama, and the United Nations Educational, Scientific, and Cultural Organizations (UNESCO) Associated School Conferences for ESD, as well as at eco-related meetings (Recycle Design 2019).

Over 250,000 elementary school students participated in the project between 2000 and 2018 (Figure 1). Assuming that at least one family member worked with each student, it can be estimated that over 250,000 additional family members were involved in the project. Furthermore, cumulatively, through the aforementioned exhibitions, public records show that the diaries would have been seen by approximately 110,000 visitors by the end of 2018. Therefore, it can be estimated over 610,000 or 16% of Yokohama citizens would have been directly or indirectly involved in the project.

While undertaking a case study of an innovation such as this, Yin (2018) underscores the importance of differentiating between the contents of a project (i.e. the eco-picture diary) and the process of implementation (i.e. how it became widely accepted). Therefore, before exploring

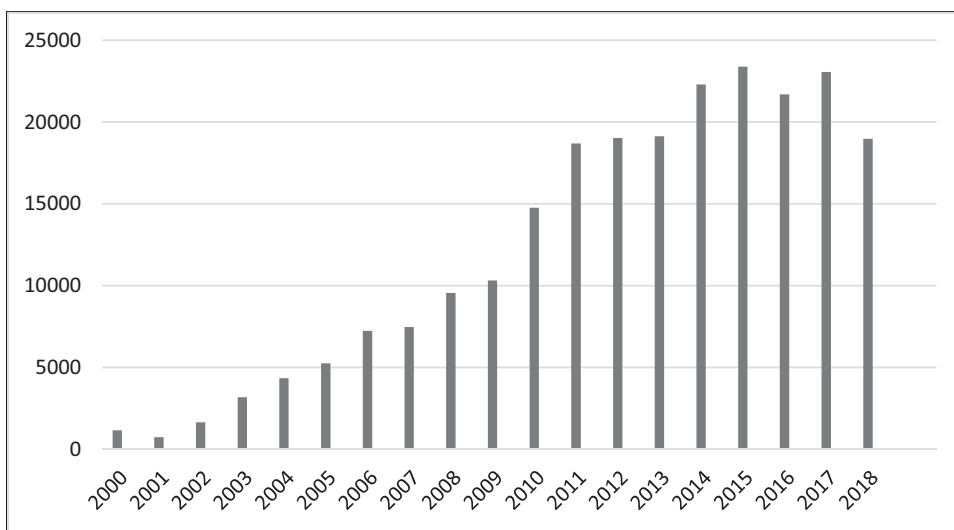


Figure 1. Number of students who participated in the eco-picture diary project.

the uptake process and outcomes, it is important to describe the eco-picture diary as an instructional tool. In brief, the eco-picture diaries have distinctive characteristics, such as: a backcasting approach, reflecting journaling, eco-pedagogy, and place-based education.

Eco-picture diary as a backcasting approach

In Yokohama, the eco-picture diary project was designed to exemplify a form of backcasting, in order to help envision, plan, and realize a desirable sustainable society. Vergragt and Quist (2011) define backcasting as an approach that generates an image of “a desirable future, and then works backwards from that future to the present...by developing agendas, strategies, and pathways how to get there” (747). For EE, Kopnina (2014) explains that, “future scenarios and visioning have proved useful for environmental education because they make participants feel responsible and empowered to take action to reach their vision for a better community by raising their awareness of environmental issues” (219). In defining and evaluating the desirability of different future scenarios (Mendoza et al. 2017), students have an opportunity to influence the attitudes and thought processes of other stakeholders, and participate in challenging or changing unsustainable development paths (Lehtonen 2012). This particular backcasting approach also supports another characteristic of the eco-picture diary project: involving multiple stakeholders at different levels, so as to enable them all to address socio-environmental issues holistically, including more recently, in relation to the SDGs.

Eco-picture diary as reflective journaling

Eco-picture diaries are also positioned as a type of reflective journaling. Hubbs and Brand (2005) explain that the rationale for reflective journaling is based on experiential learning theory. Kolb (1984) highlights the following reflective processes of experiential learning: 1) concrete experience; 2) reflective observation; 3) abstract conceptualization; and 4) active experimentation or application. In the first three stages, the students are invited to describe an experience, reflect on it, and explore the meaning of the experience. Finally, the student reconstructs his or her existing knowledge by replacing or modifying it with newly acquired knowledge. Vinjamuri, Warde, and Kolb (2017) state that in this reflective process, the self-awareness of students

regarding their learning is enhanced and consequently they begin to take more responsibility for their learning. The eco-picture diaries include images as well as text. Hansen and Machin (2013) state that, “the interaction of text/language and image/visuals has received considerable attention in the literature on visual environmental communication” (159) because this interaction helps in activating multiple cognitive abilities for reflective learning (Mayer and Sims 1994) and differentiates the diary from basic journal writing (including that focused on nature).

Eco-picture diary as ecopedagogy

An explicit aim of eco-picture diaries is social transformation (Recycle Design 2019). When used as an educational tool, this is sympathetic to the goals of ecopedagogy. Misiaszek (2016) explains that ecopedagogy deliberately draws on critical theories, including the reflective assessment of social structures to identify, challenge, and transform them (Morrow 1994). The focus has to be progressive rather than retrospective: it involves constructing praxis through an iterative process of reflection and action toward transforming social systems (Freire 2000). Nogueira (2018) states that ecopedagogy should be pursued when EE and ESD support the transformative and emancipatory perspectives, as opposed to neoliberal ends-in-view, to promote democratic participation. In these situations, ecopedagogy can help learners analyze and narrow the underlying gap between the current situation (which is not ideal) and the wish for a future situation (which is ideal). They can then take actions to address the socio-environmental issues through critical reflection and action about their local environment (Misiaszek 2016).

Eco-picture diaries as place-based education

The eco-picture diary also affords a place-based education, as it helps nurture the students' sense of Yokohama, and the issues it faces. Sense of place is defined as an awareness of the values of an area, such as a neighborhood or a city (Tyson 2009), and can help learners develop place meanings and attachment (Lichrou, O'Malley, and Patterson 2014). Place attachment is indicative of how strongly people feel about a place, while place meaning describes the reasons for this feeling (Kudryavtsev, Stedman, and Krasny 2012). Smith (2007) asserts that place-based education exemplifies the vision of critical environmental education, i.e. is ecopedagogical. However, place-based education can also refer to a wide variety of civic educational programs in which students learn about the local environment, typically through experiential learning (Hutchinson 2004).

Gruenewald and Smith (2008) notes that place-based education should oppose “the isolation of schooling's discourse” (620), and emphasize inclusion of the community in the resolution of socio-environmental issues (Efird 2015). This is important if we accept that people are more likely concerned about the environmental issues pertaining to the area where they reside than other places. For example, Hung (2014) notes that once a place becomes significant for a person, “it turns into a part of self-preservation which consists in preserving one's past and memory and anticipating the future” (1398), and thus the person is more likely to work toward protecting the environment of that area.

Based on these characteristics, it can be stated that the eco-picture diary project may help students to develop action competence. In the context of critical EE, Jensen and Schnack (1997) explain that action competence is the ability to take concrete actions to address local socio-environmental problems. Action competence entails knowledge and insight (e.g. environmental knowledge), commitment (e.g. enhancement of motivation), vision (e.g. planning to change the current conditions into something envisioned in the future), and action experiences (e.g. taking concrete actions to solve socio-environmental issues) (Bishop and Scott 1998). Mogensen and Schnack (2010, 62) further describe that “the action competence approach points to democratic,

participatory, and action-oriented teaching-learning that can help students to develop their ability, motivation, and desire to play an active role in finding democratic solutions to problems and issues connected to sustainable development.”

These features of the eco-picture diary project are illustrated in the case study. However, the extant literature and documents on this initiative in Yokohama do not sufficiently account for: 1) the possible effect of the diary on eco-initiatives, notably G-30; 2) how stakeholders perceive the diary as an EE/ESD instructional tool, and 3) the reasons that made the diary popular. The current article attempts to fill these gaps.

Research design

This study is based on a case study approach, employing both quantitative and qualitative empirical methods (Stake 1978). In this instance, the Yokohama eco-diary project is the case to be investigated in depth, to develop understandings of what it is and how and why it works (Yin 2018). While a case study can entail quantitative analysis, in this instance, our goal is analytical rather than statistical generalization, i.e. the focus is on the possible contribution to the expansion and/or application of theories or the extant literature related to the case (Cohen, Manion, and Morrison 2011). Yin (2018) also reminds us that exemplary case studies are unusual and of wider interest as a result. The eco-picture diary project falls into this category as it became more popular than other similar projects in the region and appears to have made a significant contribution to the success of the G-30 program in Yokohama. Moreover, the diaries have drawn the attention of various stakeholders, including policy makers, scholars, and practitioners in eco-related fields.

Methods

Questionnaires were administered to 1,159 Yokohama citizens through a professional research agency employed to examine participants' perceptions on the possible effect of the eco-picture diary on garbage reduction. The citizen participants were asked whether they knew about Yokohama's eco-picture diary, and to indicate their perceptions on whether the diary had a positive impact on garbage reduction, using a Likert-type scale.

Open-ended, in-depth interviews were conducted with a range of stakeholders. These participants included three city personnel, three staff members from Recycle Design, two elementary school teachers, one elementary school principal, one member of the Board of Education, and one president from a private company. These participants were recruited through a snowball sampling method, starting with personnel from Yokohama City. We asked interviewees to share their interpretation and opinion about the eco-picture diary as an instructional tool as well as how and why the eco-picture diary project became popular. The interviews took place in a mini-focus group, with three to four participants in each group, “to facilitate conversation because mini-focus groups are easier to recruit” (Daley 2013, 11) and to examine the topic in depth (Anderson 1998). The protocol for data generation from these interactions was designed to yield “insights that might not otherwise have been available in a straightforward interview” (Cohen, Manion, and Morrison 2011, 436).

Data analysis

The quantitative results of the questionnaire study were compiled for descriptive analysis, while narrative analysis techniques were employed to analyze the qualitative data. Narratives record a sequence of stories (Haenssger 2020) and help to present the experience holistically (Webster and Mertova 2007). We used a logic model to organize a series of events over an extended

period of time to illustrate how a complex activity such as a program or a project is undertaken and received (Yin 2018). In this instance, the events are relayed “in repeated cause-effect-cause-effect patterns, whereby an outcome (event) at an earlier stage can become the stimulus (causal event) for the next stage, in turn producing another outcome that becomes yet another stimulus” (Yin 2018, 186). NVivo (Version 10) was used to organize and code the qualitative data.

Reliability and validity

Case studies are not immune from questions related to reliability and validity (Yin 2018) about their data sets and analysis.

To enhance the likelihood of reliability in the methods, Cohen, Manion, and Morrison (2011) argue external researchers should be able to “track through every step of the case study from its inception to its research questions, design, data sources, instrumentalization, and data” (295). As recommended by Gerring (2017), we recruited a group of professional researchers to repeat the analytical processes and discussed the findings with them. Inter-coder reliability was also calculated for reliability. A score of 0.65 for Cohen’s Kappa suggests there was substantial agreement between raters.

To enhance the likelihood of validity in the research, it is imperative to connect the case with appropriate theories for it to be analytically generalizable (Yin 2018). It is also recommended that researchers cross check with their interviewees if their responses are properly reflected in the results of and conclusions drawn from the analysis (Gerring 2017). Both were also carried out for the case study, as illustrated above for the former.

Results

Table 1 compiles socio-demographic information about the participants, their knowledge about the eco-picture diary, and perceptions of the effect of the eco-picture diary on garbage

Table 1. Socio-demographic information and knowledge about the eco-picture diary.

Sex	n	%
Male	587	50.6
Female	572	49.4
<i>Total</i>	<i>1159</i>	<i>100.0</i>
Age		
15-19	107	9.2
20-24	83	7.2
25-29	95	8.2
30-34	80	6.9
35-39	114	9.8
40-44	120	10.4
45-49	145	12.5
50-54	128	11.0
55-59	106	9.2
60-64	108	9.3
65-69	73	6.3
<i>Total</i>	<i>1159</i>	<i>100.0</i>
Knowledge about the eco-picture diary		
Yes	153	13.2
No	1006	86.8
<i>Total</i>	<i>1159</i>	<i>100.0</i>
Perception of the diary’s impact on garbage reduction		
Strongly agree	13	8.5
Agree	72	47.1
Neither agree nor disagree	62	40.5
Disagree	4	2.6
Strongly disagree	2	1.3
<i>Total</i>	<i>153</i>	<i>100.0</i>

Table 2. Breakdown of the percentage of knowledge about the eco-picture diary by sex and age ($n = 153/1159$).

Sex	n (Table 1)	% (Table 1)
Male	82 (587)	13.9 (50.6)
Female	71 (572)	12.4 (49.4)
Total	153 (1159)	100.0
Age		
15–19	40 (107)	37.4 (9.2)
20–24	17 (83)	20.5 (7.2)
25–29	6 (95)	6.4 (8.2)
30–34	8 (80)	10.0 (6.9)
35–39	9 (114)	7.9 (9.8)
40–44	11 (120)	9.2 (10.4)
45–49	21 (145)	14.4 (12.5)
50–54	10 (128)	7.8 (11.0)
55–59	16 (106)	15.1 (9.2)
60–64	7 (108)	5.5 (9.3)
65–69	8 (73)	11.0 (6.3)
Total	153 (1159)	100.0

reduction. Table 2 shows the same findings but only for those participants with knowledge of the eco-picture diary.

Among the total respondents, 13.2% of them reported that they knew about the eco-picture diary (Table 1). This figure is lower than our broader estimate that approximately 16% of Yokohama citizens would be aware of the eco-picture diary project. This may be because the current study did not include children under 15 years old, the target group for the project. While the eco-picture diary is more than 20 years old, it has become particularly popular in the last ten years or so, and the majority of students who have directly used it may still be under 20 years old. Indeed, among those who reported that they knew about the eco-picture diary, 37.4% of late teens and 20.5% of those in their early twenties reported that they knew about the eco-picture diary, while only 6.4% of the respondents in their late twenties reported so, arguably because they did not have opportunities to be involved in the diary project as either students or parents (Table 2). However, 55.6% of those who reported that they knew about the eco-picture diary project claimed that the diary contributed to the city's garbage reduction while only 3.9% of them reported that it had not. This indicates that the eco-picture diary has generally been perceived as a contributing factor to garbage reduction.

Contents of the eco-picture diary as an instructional tool

As shown below, respondents treated the eco-picture diary project as illustrative of different facets of place-based education, ecopedagogy, backcasting, and reflective learning.

Place-based education

A member of the Recycle Design staff reported that one of the benefits of the eco-picture diary is that it enables students to discuss local socio-environmental issues with their family members, i.e. it can support intergenerational learning:

Even if students were initially not interested in socio-environmental issues in Yokohama, they are happy to share their opinions about these issues with their family members. Likewise, even if their family members were not interested in addressing these issues, they will listen to the children in part because the eco-picture diary is a school assignment. Additionally, employees from local companies will be involved in evaluating eco-picture diaries and participating in awards ceremonies for those that are highly valued.

The president of a Yokohama-based company, whose employees primarily come from the city, and thus whose families may include students using the project materials, added:

I feel that the diaries have a ripple effect. In my company, for example, in evaluating the eco-picture diaries, all employees write comments, explaining why they selected the ones they did. Our employees, including me, have created our own eco-picture diaries as well. The process helps us understand how we should address local socio-environmental issues.

Here, we note place-based education can be amplified by alignment and interactions within different sectors of society in the locale, e.g. intergenerational awareness and learning are unlikely to only be amongst family members.

With regard to involving citizens more broadly, a member of the city hall personnel said:

Through occasions such as exhibitions that are held in various places such as JICA Yokohama or at UNESCO Associated School conferences, local citizens also have an opportunity to look at the eco-picture diaries and become aware of local socio-environmental issues and the possible solutions to address them.

Given their focus on addressing local socio-environmental issues in Yokohama, these comments indicate the characteristics of the eco-picture diary as a place-based environmental education tool.

Ecopedagogy

A Recycle Design staff member conveyed a child's concern that current world trends, including SDGs, prioritize economic aspects of development over ecological and social ones.

Due to the long working hours as a result of the excessive emphasis on the economy, when asked to write and draw a desirable future in the eco-picture diary, one first-grade student wrote, "I would like a world where parents and children can have meals together," and accompanied these words with a drawing of a family having a meal together. We adults should not let a young child say something like that. However, without the eco-picture diary, we would not even know what the children think about these topics.

A member of the city hall personnel reported that children are fully aware that the current situation needs to be changed:

We hold annual environmental conferences in collaboration with Recycle Design for children who have submitted the eco-picture diary and ask them to discuss what they want the future of Yokohama to be like. I asked them why they decided to participate in the conference. They told me that the way things are now is not acceptable and has to be changed. For example, they said, "Yokohama is clean but does not have enough green spaces. What if aliens observe the city from outer space? They would not like to come visit us."

Such statements starkly dramatize some of the ecopedagogical aspects of the eco-picture diary project, identifying what exactly in this particular place needs to be transformed.

Reflective journaling

A primary school principal reported that one of the advantages of the eco-picture diaries is that it has both pictures and texts:

The eco-picture diaries ask children to identify reasons why the current socio-environmental issues exist and to propose solutions through pictures as well. We can tell that children really think hard before writing down or drawing their thoughts. This reflective process enables them to acquire critical thinking skills that are necessary to deal with not only current but also future issues.

Such statements illustrate the ways in which the eco-picture diary is a reflective learning tool.

Backcasting

A Recycle Design staff member confirmed they saw the eco-picture diary as a backcasting approach in that children write and draw on the theme of a desirable future city:

The eco-picture diaries reflect on the clear action plans of steps that children and other stakeholders can take toward an ideal future. These action plans are elaborated on by family members and thus become a

stronger and more sustainable driving force than individual action plans. After all, what children discuss with their family members, including socio-environmental issues and strategies to address these issues, becomes a family commitment.

The Research Design staff continued explaining that the eco-picture diary becomes a proposal from children to adults:

The “messages” from children conveyed through eco-picture diaries contain valuable suggestions for the future city planning authorities to work towards achieving SDGs by 2030 through a transformation of the social system.

Process of implementation

Why are these initial observations significant? If we return to the late 1990s, we note the landfills in Yokohama were filling up. During a focus group, a member of Yokohama city personnel reflected the general perception at the time that: “It was high time we took this seriously.” In 2000, as a measure to address this issue, Recycle Design introduced the eco-picture diaries at elementary schools in Yokohama. A Recycle Design staff member shared, “We decided to initiate the eco-picture diary project to encourage students and their family members as well as teachers, to discuss environmental issues notably those related to recycling of garbage wastes.”

Another Recycle Design staff member stated, “To start the eco-picture diary project, we first went to elementary schools and talked to teachers randomly to encourage them to adopt the eco-picture diaries.” To continue the narrative, we heard that students were instructed by their teachers to talk to their family members about what to write and draw, for example, about the 3Rs. An elementary school teacher shared that, “Even if students were not interested in 3Rs at first, they were happy to tell their family members whatever they learned at school” and “their family members would listen to and collaborate with the students in part because the eco-picture diaries were a school assignment.” A Recycle Design staff member stated that as a result, “What they discussed, then, became a family commitment.”

Promoting the eco-picture diaries was a challenging task. A Recycle Design staff member reported, “We received about 1,000 eco-picture diaries in the first year and fewer than that in the second year of the project.” A member of the Board of Education affirmed, “The eco-picture diary gained little popularity in the first few years of the project. At that time, a lot of people and organizations introduced projects that were similar to the eco-picture diaries. However, most of them stopped the projects after a year or so, as they expected that their project would gain popularity soon, but it did not.” An elementary school principal said, “Persistence is the key to success. If a project continues for several years consecutively, it makes us think if we should do it again the following year.” A member of the Board of Education stated, “While the Recycle Design and the eco-picture diary project were hanging in there during the first few years, *sou-gougakusyu no jikan* [Integrated Studies] was integrated into the curricula by the Ministry of Education, Sports, Science, and Technology (MEXT). At that time, recycling was to be taught as a part of Integrated Studies in school.² “The timing was perfect. Teachers were puzzled and asked how they could teach recycling. Then, we thought of Recycle Design and the eco-picture diary. A number of teachers had already heard of the eco-picture diary through word of mouth (WOM)” (Elementary School Principal).

In 2003, Yokohama City implemented the G-30 program to reduce garbage waste production by promoting the 3Rs. A member of the Board of Education shared that as a part of this program, “All schools in Yokohama had to officially start teaching the 3Rs. While many teachers did not have the expertise, the Recycle Design team already had more than three years of experience in the field. At this point, an increasing number of teachers decided to collaborate with Recycle Design and adopt the eco-picture diary.”

In 2008, Yokohama was designated as an eco-model city by the Japanese government. A main priority of an eco-city is to become a low carbon society (Low 2013). At this point, the theme of the eco-picture diary was changed from 3Rs to “how to reduce GHG emissions.” In 2010, the city was selected as one of the Eco2 Cities by the World Bank, along with Curitiba, Stockholm, Singapore, Brisbane, and Auckland. A member of Yokohama City personnel reported, “Yokohama is the only Japanese city that was selected for this eco-initiative” and this “drew much attention from national and international communities.” The Asian Pacific Economic Cooperation (APEC) conference was held in Yokohama in the same year. A Recycle Design staff member shared, “We [the Recycle Design] collaborated with APEC and agreed on the carbon emission off-set deal by writing and drawing an eco-picture diary.” That is, writing and drawing an eco-picture diary became considered equal to offsetting 1 kg carbon emissions, which can be donated to the Japanese government.

In March 2011, the Great East Japan Earthquake occurred. A member of the Board of Education stated, “That was when we Japanese desperately thought something must change in our lives, for example, in terms of saving energy and protecting the environment.” In the same year, as a response to the environmental and energy issues related to the earthquake, the Japanese government introduced the eco-future city initiative by selecting eleven cities as eco-future cities, many of which were gravely affected by the earthquake (Japan for Sustainability 2014). While not directly affected, Yokohama was also selected to share its experience in dealing with socio-environmental issues.

A staff member at Recycle Design mentioned that from 2012, “Through collaboration with other Japanese eco-future cities (Higashi Matsushima, Miyagi; Kashiwa, Chiba; Minami Souma, Fukushima; and Shimokawa, Hokkaido), other Japanese cities (Kouchi, Kouchi; Naha, Okinawa), an Eco2City (Curitiba, Brazil), and Yokohama’s sibling city (San Diego, USA), the eco-picture diaries were introduced at schools in all these cities as well.” Another staff member stated, “It happened to be the time that MEXT changed the content of the instructional guidelines. Due to the [after] effects of the Great East Japan Earthquake, citizens as well as the government seriously started addressing socio-environmental issues, which helped promote environmental education in general and the eco-picture diary in particular.”

In 2015, the SDGs were agreed during the General Assembly of the United Nations. A Recycle Design staff member stated, “Based on the SDGs, the themes of the eco-picture diary were broadened. Not only 3Rs or low-carbon emissions but almost all socio-environmental issues were made the themes for the diary.” The staff member also shared that, “After the SDGs were established, a number of private companies became actively involved in the eco-picture diary project. Their involvement through evaluation of the eco-picture diaries and participation in award ceremonies for participating in the eco-picture diaries counted toward their corporate social responsibility (CSR) demands and also provided students and teachers a recognition of their work in society, and a sense of being democratic citizens.” A Yokohama-based company’s president said, “We have been cooperating for the eco-picture diary project because we find it useful to understand how our employees feel about addressing socio-environmental issues and how to articulate our social mission. Companies like ours now have to express their commitment to take action toward achieving SDGs in a visible way, and the eco-picture diary is a means of doing so.”

In 2015 itself, more than 23,000 students from 281 schools participated in the eco-picture diary project. A member of the Board of Education said, “Approximately one out of every six elementary school students in Yokohama participated in the project. That is a lot of participants. At this level, even teachers who were not very motivated to engage in EE or ESD started using the eco-picture diary, as the use of the diary became a kind of social norm.” A Recycle Design staff member shared, “In 2018, Yokohama collaborated with Japan International Cooperation Agency (JICA) and the eco-picture diary was introduced and used in thirteen African countries (Egypt, Gabon, Cameroon, Kenya, Sudan, Zambia, Dibouti, Tanzania, Niger, Burkina Faso, Botswana, Malawi, and Mozambique). By this time, the diary became a global tool.” The member

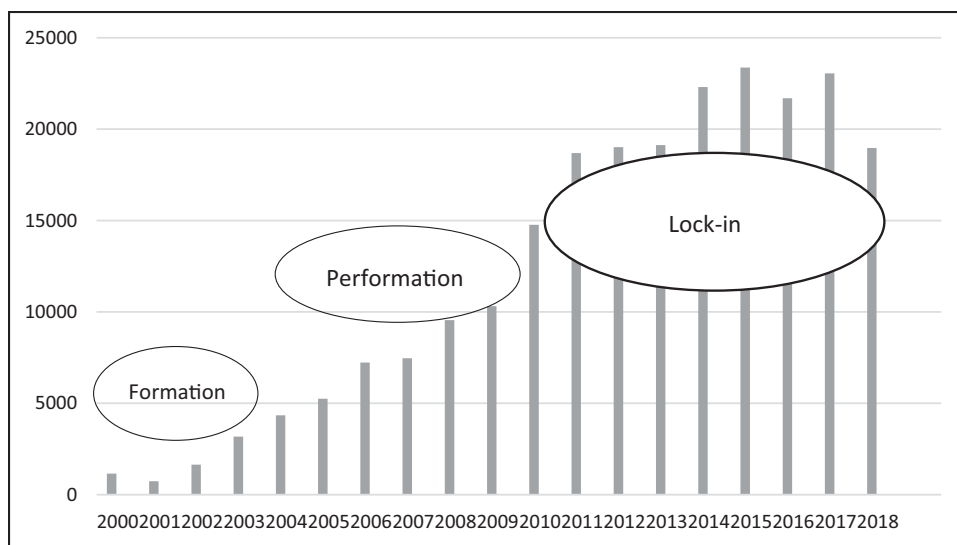


Figure 2. Number of students who participated in the eco-picture diary project.

of the Board of Education concluded, "From April 2020, the SDGs will be a part of textbooks. As a result, the eco-picture diary might become even more important and popular, as it is a convenient instructional tool to teach SDGs."

Discussion

This research has described the eco-picture diary project (i.e. their contents) and how they became popular (i.e. the process) through interviews as well as confirming the effect of the eco-picture diary on the eco-initiative (G-30) through questionnaires. In terms of content, by describing "the desirable future city, Yokohama," the eco-picture diary project affords backcasting, ecopedagogies, reflective and place-based approaches within EE. All these characteristics help develop action competence to varied degrees in order to solve socio-environmental issues, but not necessarily as ESD (Nomura and Abe 2009).

In terms of understanding the particular process of adoption of social marketing techniques, we draw on Ngoasong and Kimbu (2019), who describe the following stages in development: *formation* (start-up), *performance* (take-off or early stage), and *lock-in* (high growth and established). With the eco-picture diaries, the formation stage appears to be from 2000 to 2003 (on average, 1,678 submissions), i.e. when EE rather than ESD was the main discourse about education and socio-environmental issues in Japan.

The performance stage for the project is from 2004 to 2009 (on average, 7,360 submissions), and the lock-in stage is from 2010 until the present date (on average, 20,000 submissions) (Figure 2). From mid-2015, the eco-picture diary probably entered a maturity stage with stable but slow growth (Johnson, Whittington, and Scholes 2011).

During the formation phase, Recycle Design continued to be a part of the informal education market, in spite of initial struggles and competition. Heiens, Pleshko, and Al-Zufairi (2015) state that multi-year consistency is important for branding and marketing organizations to establish their social marketing products and services. As a member of the Board of Education reported, the fact that Recycle Design stayed in the 'education market' for the first several years, while competitors dropped out, is a key factor in the success of the eco-picture diary.

We asked the Recycle Design staff why they continued the project. One replied, "I personally do not believe that 1,000 submissions in the first year of the project is a poor figure. After the

first year, the city government invited us to co-organize an eco-event. We were so busy preparing for the event that we could not promote the eco-picture diary as much as we did in the first year. As a result, the number of submissions decreased in the second year.” The staff member continued, “The eco-event was successful and the seats were full. This motivated us to continue the project in the following years.”

While the eco-picture diary was at the formation stage, the school subject, Integrated Studies, was introduced into the curricula in 2000 (Nomura and Abe 2009), and the G-30 program was implemented in 2003. Both the subject and program required teachers to teach 3Rs and helped expand the reach of the eco-picture diary. During the performance and lock-in stages of the diary, the 2008 eco-model city initiative, the 2010 Eco2 Cities initiative, the 2010 APEC conference, the 2011 eco-future city initiative, the 2012 curriculum change held more power on shaping the project than the UN Decade of ESD (Kodama 2017). This sidestepping of ESD collapses though with the 2015 global agreement on SDGs. All teachers in Japan were urged to teach an environmental curriculum, for example, carbon emissions reduction and SDGs, but not all of these suitable for primary education, or a project in a ‘lock-in’ phase.

An elementary school teacher also pointed out the flexibility and ease of use of the eco-picture diary. For instance, “As it is not a compulsory requirement as per the government, teachers are not pressurized and adopt it flexibly.” Additionally, another elementary school teacher stated, “The ease of use and its compatibility with education are the major reasons why it became so popular.” All these factors and situations appear to have greatly contributed to the popularization of the eco-picture diary project from the mid-2000s. Nonetheless, it is not that Recycle Design happened to be in the right place at the right time as a matter of chance. In the next section, we further explore theoretical and practical implications from the findings that may help to generalize this case study analytically.

Implications and suggestions

According to Rogers’s (2003) diffusion of innovation theory, innovation is not necessarily objectively new. Indeed, the concept of the eco-picture diary itself was not new. The Panasonic Corporation, for instance, conducted a similar program called “The Eco Picture Diary Global Contest”, which attracted more than 300,000 works from 47 countries between 2008 and 2013 (Panasonic 2013). However, the management process that Recycle Design used to promote its eco-picture diary had some unique attributes.

Returning to our theoretical framework, innovations with relative advantages, compatibility, trialability, and observability are those that tend to be adopted more rapidly than other innovations. The eco-picture diary may offer some relative advantages as an instructional tool for teachers who struggle with teaching the 3Rs, and then the SDGs. As some interviewees mentioned, the eco-picture diary is conceptually and technically easy for teachers to understand and adopt because it is compatible with a range of forms of, and imperatives for, education. It is also flexible to use and is not established as a mandatory requirement by the government. Accordingly, the teachers can try it out and decide to use it or not as per their convenience. This affirms the concept of trialability. The output of the diary is also evident through the number of submissions that are exhibited throughout the city and seen by the attendees. This leads to observability.

Diffusion of innovation theory also describes communication channels as a means of delivering messages among individuals, with interpersonal channels being more effective than impersonal channels in persuading an individual to accept innovations. As mentioned by a Recycle Design staff member, WOM has been an effective communication tool to promote uptake of the eco-picture diary project.

Time is an important dimension in the innovation-decision process through awareness/knowledge, persuasion, decision, and confirmation/continuation. Applying this process in the context

of the eco-picture diary, teachers first became aware of the need to teach 3Rs, then GHG emission reductions, and today, the SDGs. In each instance, they sought relevant educational material from Recycle Design. In addition, we note that the teachers acquired a positive attitude and intention after learning about the eco-picture diary. Finally, a broader body of teachers adopted it and continued using it.³

We noted earlier that diffusion occurs within a social system whose structure provides a context for regularity and stability to human behavior within that system. In Yokohama, social norms can be seen to affect the rate of adoption of new innovations as they influence the behavior of individuals. As a member of the Board of Education mentioned, the use of the eco-picture diary became a social norm during the lock-in stage (as confirmed by the member of the Board of Education).

Diffusion of innovation theory also shares similarities with some aspects to theories of planned behavior (TPB). In the case of the eco-picture diary, teachers and other stakeholders could acquire a positive attitude to teaching about socio-environmental issues, develop and share subjective norms, and exercise perceived behavioral control to form behavioral intentions favorable to its adoption. Teachers developed a positive attitude toward the diary because of the aforementioned relative advantage: that the diary fulfilled their teaching needs. The ease of use and flexibility (complexity and compatibility) also provided teachers with control. As a number of teachers began using the eco-picture diary, other teachers felt that they could use it as well, and this supported the creation of a social norm.

The eco-picture diary project also shares social marketing elements consistent with similar projects in EE that assess a social problem, influence social change within the target population, and formulate a social marketing mix (Heimlich and Ardoin 2008). In the case of the eco-picture diaries, pertinent local socio-environmental issues were analyzed. Influencing social change within the target population was done by encouraging teachers to adopt the eco-picture diary and by involving various stakeholders at different levels. We also detected that the social marketing mix included the following 4Ps or 4Cs:

Product/Customer: While eco-picture diaries are tangible products, and pro-environmental behavior is an intangible product adopted by customers (e.g. students, teachers, family members, and other citizens), a notable feature of the social marketing approach is a persistent focus on customers (Neiger et al. 2003). To meet the needs and demands of teachers, who are the immediate 'customers', the Recycle Design staff gradually worked toward evolving the eco-picture diary. The staff mentioned, "Elaborating on the themes for the eco-picture diaries, we listened to teachers and took their ideas. We also chose themes in accordance with national and city policies because teachers are motivated to employ EE/ESD due to these policies."

Price/Cost: Price consideration relates to exchange among stakeholders, which in turn is related to positioning (Neiger et al. 2003). The Recycle Design staff persevered, which is one of the most critical attributes for social innovation (Wagner 2012) in reducing perception of relative cost of adoption, until they secured their position against competitors in the market. Despite initial failures, the staff did not give up during the formation stage, while apparently, other organizations did in Japan (Ando and Noda 2017). This is a crucial factor because, as mentioned earlier, passage of time is essential for the adoption of innovations (Rogers 2003).

Place/Channel: In broad social marketing terms, place is the location of services. The eco-picture diary is an instructional tool, which may give the impression that it is exclusively used in schools; however, stakeholders other than students and teachers also have opportunities to be exposed to it at various occasions such as at home, in exhibitions, and at work, which may have helped popularize it. (Analysis of social media references to the project was not part of the scope of this study, but could be another line of inquiry.)

Promotion/Communication: In establishing ownership and securing long-term commitment, participatory communication tools are important (Tyson 2009). While creating eco-picture diaries

includes such participatory communication that involves various stakeholders, WOM amongst teachers in particular, also played an important role in popularizing the project.

Nevertheless, for a case study to be analytically generalizable, it needs to be examined in relation to existing theories or literature (Stake and Trumbull 1982). With the application of diffusion of innovation theory and TPB, we now explore how the eco-picture diary can be used in different contexts (in fact, we note it is already in use in cities other than Yokohama). By applying constructs in diffusion of innovation theory and the TPB in social marketing frameworks, the eco-picture diary can be promoted even further.

Rogers (2003) suggests three main strategies to help further diffuse the use of an innovation. The first strategy is that a highly respected individual adopts an innovation within a social network, resulting in creating an instinctive desire for the innovation. The person would function as a change agent or an opinion leader, who introduces the innovation to the community. If a highly respected individual sponsors or adopts an innovation, a large number of people are likely to have a positive attitude toward it. Following that, if a majority of the citizens adopt the innovation, it becomes a social norm.

Another strategy is sharing an innovation with a group of individuals who would readily use it and would disseminate information about its benefits, thereby creating a positive attitude for early adopters. As more and more individuals adopt the innovation, it will become a social norm. Given that the second approach has been applied in the eco-picture diary, the integration of the first strategy might help to further promote it. The cost of involving highly respected person(s) would not be very high as there are a number of Japanese celebrities who would like to make contributions to benefit society (e.g. Ministry of Economy, Trade, and Industry 2009). The influential person could post some positive information about the eco-picture diary on her or his social networking sites and this would further promote it.

Both strategies align with a third strategy, and current focus of social marketing: systemic social change (Brennan and Binney 2008; Kennedy 2016). The eco-picture diary is an example of a macro-social marketing instrument for systemic change, as it involves various stakeholders at different levels.

However, the following factors may also be considered important to promote the eco-picture diary or similar projects in such ways. First, the contents of the eco-product are essential. The eco-picture diary has served as instructional material to teach aspects of EE and more recently, ESD, supported by theoretical groundings, such as backcasting, reflective journaling, ecopedagogy, and place-based education. The eco-picture diary also has compatibility and trialability as well as minimal complexity, all of which offer relative advantage to teachers. Nonetheless, the contents of the product alone, as with other forms of EE and ESD, are insufficient to explain its success.

In analyzing the process of how the usage of the eco-picture diary became prevalent, the social market orientation of Recycle Design is significant. Laukkanen et al. (2016) aptly summarize that the concept of market orientation refers to the marketing strategy in which the ultimate goal is satisfying the needs of customers better than competitors do, by generating “market information on the present and future needs of customers” (675). As noted, market orientation typically focuses on customers and their current and future needs (Gromark and Melin 2013). Recycle Design staff understood the needs of teachers as customers through regular interaction with, and feedback from them. They adjusted the contents of the eco-picture diaries, including adopting policy changes and meeting the expectations of various movements at the local, national, and global level. Over time, this satisfied the needs of teachers ranging from teaching about the 3Rs to low carbon emissions and even to SDGs over time.

The persistence and/or perseverance of Recycle Design is also an essential factor for the diary's success. Along with the willingness to experiment and the capacity for design thinking, perseverance is widely recognized as one of the most critical attributes for innovation (Wagner 2012) and persistence is strongly related to market penetration (Woerter 2014). As emphasized

during the interviews, the staff at Recycle Design were patient and did not leave this dual sector civil and educational market, despite initial struggles, and as a result, the project succeeded better than those of their competitors.

It is also important to note that external contingency circumstances, such as the introduction of Integrated Studies in 2002, the implementation of the G-30 program in 2003, the 2008 Eco-model city initiative, the 2010 Eco2 Cities initiative, the 2010 APEC conference, the 2011 Eco-future city initiative, the 2012 curriculum change, and the 2015 global agreement on SDGs, all likely impacted the stakeholders' recognition and use of the eco-picture diary to different degrees. While the study was not designed to account for these, we note that these national and global moves were beyond the control of the diary's innovators (in this case, the Recycle Design staff), but they did help stakeholders recognize the value of adopting and reworking the eco-picture diary initiative.

Conclusions

This case study described the eco-picture diary and examined how it became popular as well as confirmed the effectiveness of the diary in the eco-initiative (G-30 program). It provides theoretical and practical implications to generalize the findings so that they can be applied to a wider context.

We conclude with a note on several limitations. Given the qualitative nature of much of the data for the case study, the sample size is too small for statistical analysis. For instance, although diffusion of innovation theory and TPB were used for the analytical generalization of the case, the factors that account more for predicting the adoption are unknown. In future research, this could be addressed via a questionnaire survey with a response target of a larger number of teachers who have adopted the eco-picture diary, and by conducting structural equation modeling to quantify and clarify the contribution of each factor toward adopting the diary. We acknowledge that reference to the UN Decade of Education for Sustainable Development (2005–2014) in Japan (Mochizuki 2017) was noticeably absent in the transcripts, while equivalent projects and initiatives from other providers were not investigated or compared either, nor have we assessed the eco-picture diary projects implemented in other cities, and the power of other theories to explain the findings, including in relation to action competence. We recommend addressing these gaps in future research, and bearing these concerns in mind, in reading and responding to this study.

Notes

1. Future Cities are Japan's SDGs model cities, designated to promote local government initiatives for achieving SDGs. Similarly, an Eco-city is designed to promote ecological and economic integrity for quality of life.
2. Integrated Studies was introduced to help students become more aware of environmental problems and to help them identify ways to tackle these. The program is mandatory for all primary and secondary schools. Each school has to allocate a few hours per week for environmental education. Teachers serve as facilitators in the program and local persons come in as guest lecturers. Students are required to work outside the school to identify various problem-solving methods.
3. The rate of adoption is measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation. Within the rate of adoption, there is a point at which an innovation is considered to reach critical mass to self-sustain. Innovators are the earliest adopters who are willing to take the highest risks, and will typically account for the first 2.5 percent of the adoption rate curve. Early adopters have the highest degree of opinion leadership among the adopter categories and account for the second 13.5 percent of the adoption rate curve. The early majority adopt an innovation after varying degrees of time that is significantly longer than the innovators and early adopters and accounts for the third 34 percent of the adoption rate curve. The late majority adopt an innovation after the average participants and account for the fourth 34 percent of the adoption rate curve. Laggards are the last to adopt an innovation. Individuals in this category show little to no opinion leadership and are typically the last 16 percent of the adoption rate curve.

Disclosure statement

No potential conflict of interest was reported by the authors.

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