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Master's Thesis
Academic Year 2024

Embodied Learning to Foster Sustainable Habits
in Elementary School Students:
A Case Study of the Green Youth Community
Project in Kandy City, Sri Lanka



Keio University
Graduate School of Media Design

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A Master's Thesis
submitted to Keio University Graduate School of Media Design
in partial fulfillment of the requirements for the degree of
Master of Media Design

Eman O.Ahmed

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Abstract of Master's Thesis of Academic Year 2024

Embodied Learning to Foster Sustainable Habits in
Elementary School Students:
A Case Study of the Green Youth Community Project in
Kandy City, Sri Lanka

Category: Action Research

Summary

This research investigates the impact of embodied learning methods in Sri Lankan elementary classrooms, focusing on fostering sustainable habits. It explores how practical activities enhance student engagement, understanding, and behavior. Findings reveal that students are more attentive and interactive during hands-on activities, signifying improved memory retention and comprehension. Observations of sustained positive behaviors, such as proper waste disposal, emphasize the effectiveness of these methods. However, challenges remain, such as the prevailing examination culture that prioritizes traditional theory-based learning. Despite these obstacles, gradual implementation of embodied methods shows promise for creating a more dynamic and effective learning environment. The study emphasizes the need for supportive policies and resources to integrate embodied learning into Sri Lankan education.

Keywords:

embodied learning, habit formation, behavioral change, environmental sustainability, recycling, Sri Lanka

Keio University Graduate School of Media Design

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Chapter 1

Introduction

The problem of solid waste has become a widespread formidable challenge throughout Sri Lanka. Despite the country's efforts in finding an effective solution to mitigate the environmental threats posed by solid waste remains elusive. Significant investments and numerous awareness programs have yielded limited results in improving waste management practices within the nation. In an attempt to target the rising concerns regarding the burning of plastic waste, The Japan International Cooperation Agency (JICA) launched The Green Youth Community Project in 2020 in collaboration with members of the University of Peradeniya (UP), the University of the Sacred Heart (USH) and Keio University's Graduate School of Media Design, Global Education Research Lab (GEDU). The project's aim is to build a practical solution through education by establishing a model school in Kandy city, Sri Lanka. The author's key role was designing and facilitating multiple workshops for elementary school students.

The activities were primarily designed based on the theory of embodied learning, which emphasizes the importance of the body and emotions in the learning process. By utilizing this theory, the research aims to explore and analyze the effectiveness of these methods in engaging students and their implications for promoting sustainable behavior change among elementary school students. In order to achieve this, the research utilizes a qualitative approach, using interviews with local teachers, as well as observations of classroom activities, to gather data on the effectiveness and challenges of embodied learning methods. The analysis focuses on understanding the experiences and perceptions of educators and students, providing a comprehensive view of the impact of this teaching practice.

The findings of this study are expected to contribute to the body of knowledge on innovative educational practices, offering insights into how embodied learning can be effectively integrated into elementary education. By demonstrating the potential benefits of these methods, the research aims to inform educators, policymakers, and stakeholders about the value of interactive and practical learning experiences in fostering sustainable behaviors and lifelong learning.

Chapter 2

Literature Review

2.1. Theoretical Framework

2.1.1 Sustainable Development Through Education

The multiple threats posed by environmental degradation and climate change have reached an abnormal level of urgency. Education holds the ability to transform environmentally harmful lifestyles and behaviors by broadening knowledge, ingraining values, cultivating beliefs, and transforming attitudes. As the impact of human activities becomes increasingly evident, the focus shifts to education and its potential to drive positive change.

Education enhances environmental awareness and concern. A crucial role of education is to improve understanding of the science underlying climate change and other environmental issues. According to the 2006 PISA report, students who achieved higher scores in environmental science also displayed higher awareness of complex environmental issues. Specifically, in the 30 OECD countries participating in the survey, a one-unit increase in the awareness index correlated with a 35-point increase in the environmental science performance index. The 2010-2012 World Values Survey revealed that when respondents had to choose between protecting the environment and boosting the economy, those with secondary education were more inclined to favor environmental protection compared to those with less than a secondary education. Additionally, the 2005-2008 World Values Survey which included 47 countries reported that individuals with higher education levels were more likely to express concern for the environment.

In nearly all countries participating in the 2010 International Social Survey Programme, respondents with higher education levels were more likely to have

signed a petition, donated money, or participated in a protest or demonstration related to environmental issues over the past five years. These results emphasize the importance of education in fostering behavioral change and increasing civic engagement. Individuals with higher education levels are not only more concerned about the environment but are also more likely to participate in activism that advocates for and supports political decisions aimed at environmental protection.

Education is also a tool that helps aid people in adapting to the consequences of climate change, a need that is becoming increasingly urgent for communities facing dangerous weather events. Poorer countries in particular, are in crucial need for adaptation due to the limitations in governmental responses and severe threats to livelihoods. Low-income countries with farmers relying on rain-fed agriculture are extremely vulnerable to the effects of climate change. A survey targeting farmers conducted in Burkina Faso, Cameroon, Egypt, Ethiopia, Ghana, Kenya, Niger, Senegal, South Africa, and Zambia showed that educated farmers were more likely to use an adaptation strategy; each additional year of education decreased the chances of no adaptation by 1.6 percent. [1]

As a tool, Education is crucial for establishing sustainable development, offering a framework where perceived tensions between economic, social, and environmental progress can be harmonized. It integrates these aspects into a unified pursuit of sustainable welfare for everyone. This extends beyond identifying education as a single Sustainable Development Goal (SDG). It necessitates a deeper understanding of education's role as an intersecting tool that enhances progress across multiple other goals. An improved understanding of education, encompassing formal, non-formal, and informal learning, establishes a robust system for fostering social learning and change.

The ultimate goal of education for sustainable development (ESD) is to create societies trained in sustainability principles and committed to living within the planet's carrying capacity. To achieve this, its implementation must be culturally appropriate, locally relevant, and incorporated across the whole society. ESD as a social measure can help cultivate a culture that respects and adheres to the princi-

ples of sustainable development. It encompasses a wide range of theories, policies, concepts and pragmatic methods/tools designed to reshape education systems to address the different dimensions of sustainable development. Education for sustainable development (ESD) promotes educational improvement that aims to provide quality education that enhances students' lifelong learning, introspection and comprehensive meaning of knowledge. It also addresses topics such as climate change and sustainable consumption while promoting skill-based learning. By utilizing action-oriented and problem-based learning approaches, ESD encourages thorough examination of worldviews, empowering learners to live sustainably using practical and daily actions making them valuable mediators of social change.

Education for sustainable development (ESD) should be regarded as a crucial means of implementation for building the necessary capacity and human/social capital to achieve the Sustainable Development Goals (SDGs). Lutz, Muttarak, and Striessnig (2014) argue that investing in education can enhance a country's adaptive capacity to climate change compared to investments in physical infrastructures, particularly in situations where the impacts of climate change are highly uncertain. Education plays a crucial role in promoting sustainable consumption by helping students recognize the environmental and social impact of their daily life decisions. It also facilitates critical examination collaborative learning, leading to the identification of new practices and sustainable solutions. [2]

2.1.2 Embodied Cognition and Education

Theories of embodied cognition proposes that cognitive processes are deeply rooted in the body's interactions with the world. Rather than viewing the mind as an abstract and isolated entity, embodied cognition suggests that mental functions are profoundly integrated with the body's sensorimotor systems. This view highlights how thinking, knowing, and understanding are all shaped by physical experiences and movements. [3]

Based on embodied cognition theories, cognitive processes are linked to the body's sensorimotor systems which simply means, thoughts can trigger a simula-

tion of the experiences associated with them. For example, grasping an object is not just a physical act but also involves cognitive processes that understand the object's use and significance. Neuroscientific research has shown that processing objects, spatial information, music, faces, flavors, odors, and even simply thinking about these concepts, activates sensorimotor responses, which are body-related activities in the brain. This is based on previous experiences related to interacting with objects, moving, eating, and smelling things. Brain regions and structures involved in this process form networks of interconnected neurons that retain and store the information. When a person holds an apple, neurons in visual and tactile regions of the brain link up to form networks representing the fruit's shape, color, and texture. These networks then connect to other networks of various scales, gradually incorporating all the experiences the individual has had with apples. Simply thinking about an apple, by activating its visual image, such as its shape, will activate other components of these networks, including motor programs for actions like grasping, lifting, peeling, smelling, tasting, and chewing the fruit.

The embodied perspective of cognition is based on sensory and motor experiences, which generate multimodal sensorimotor representations within the brain. From a purely mechanical standpoint, cognition emerges from the interconnected activity of cells in the brain. These cells respond to external stimuli, such as signals received through the ears, eyes, skin, nose, tongue, and through motor actions involving the body's organs. Consequently, the "mind," or "reason," is a function performed by the brain, an organ of the body, dispelling the notion of the mind as an abstract entity. [4]

Recent brain imaging studies found new insights in relation to cognition and language. When looking at participants in a functional Magnetic Resonance Imaging (fMRI) scanner, simply reading action words such as "step" or "punch" activated areas of the brain related to motor cortices which correspond directly to those controlling the leg and hand movements. Comparably, reading odor-related words like "cinnamon" or "jasmine" activates the brain's olfactory regions. If words were merely "symbols," abstract mental entities unconnected to the body, then performing a mental task would not stimulate the brain regions involved in sensorimotor processes associated with language acquisition and use.

In fact, when observing how children acquire language, they engage in numerous sensorimotor activities. They hear and repeat a sequence of sounds which are symbols connected to objects they perceive through their senses or to actions they perform. Children naturally explore objects by touching, dropping, smelling, and putting them in their mouths. Consequently, in the brain's representation of language, a word must be encoded as a sensorimotor network that reflects all the experiences associated with that concept. In addition to language, sensorimotor networks in the brain also signify emotions, memory, perception and higher cognitive functions. Put simply, the mind is embodied to varying extents across its various components as proven by numerous neuroscientific studies. The intertwining of the mind and the body emphasizes that Cartesian theories of the mind as being wholly separate from the corporeal body are no longer suitable reference points for educators. [5]

Almost 2 decades ago, cognitive science investigated the influence of co-speech gestures in mathematical concepts by observing gestures made by teachers. A study conducted by Susan Goldin-Meadow and colleagues examined the impact of spontaneous gestures accompanied by speech in both teachers and students. Teachers were asked to provide solving strategies in three different sets, purely orally, using gestures which reinforced the verbal message or contrasting gestures which differed from the verbal message. The gestures were integrated into the lesson and as hypothesized, children were notably more likely to adopt the strategy presented by the teacher when it was accompanied by a matching gesture compared to no gesture at all.

Oppositely, children did not benefit from gestures conveying a different solving strategy than the speech; their comprehension was improved by the matching gestures and disordered by mismatching gestures. These results suggest that gestures can provide a “second representational format” that enhances communication. When alignment between speech and gesture are combined, the visual modality added to the verbal message helps capture speech and mathematical concepts more effectively. This dual representation makes the information more accessible and comprehensible for learners. [6]

In 2015, two experiments conducted by Crollen and Noël required children aged 5 to 9 to perform tasks involving counting one target, two targets, and performing additions. Participants faced different conditions; no constraints, interruptive hand movements, and interruptive foot movements to deal with. Foot movements did not significantly disrupt counting in comparison to hand movements suggesting a connection between fingers and counting. These findings were not surprising considering the acquisition of numerical skills in childhood is closely linked to finger counting. An fMRI study, adults were presented with digits from 1 to 9 visually while lying in the scanner. Depending on the participants' counting habits whether left or right starters, hemodynamic activity was noted in the contralateral motor cortex when the digits were displayed. This neuroscientific evidence supports the concept of embodied mathematical knowledge. The tie between motor activity in the brain and counting with fingers directly correlated to Hebbian learning mechanisms which attempts to connect the neurological and psychological basis of learning. These mechanisms are active during learning, connecting cognitive mathematical operations with finger movements used in counting. [7]

Kyle Peppler recently described how counting originates in the real world. For instance, in order to count sheep we need to observe them. If our eyes are closed or the sheep are not present, we visualize an image of the animals in order to count them. We don't simply think of other abstract images; instead, we specifically visualize sheep as we have experienced them. Additionally, we use our bodies to support the cognitive task of counting, often using our fingers. We teach children basic math operations (addition, subtraction, multiplication, and division) by manipulating real-world objects—putting them together, taking them apart, cutting them etc. This process is inherently physical. Even individuals who are illiterate and cannot read or write numbers can perform these operations by referencing real-world objects. [8]

The theory of Grounded and Embodied Mathematical Cognition (GEMC) developed by Nathan and Walkington, suggests that action and gestures are effective tools for understanding different concepts related to Science, Technology, Engineering, and Mathematics (STEM). They examined geometric proofs, which require conceptual understanding of abstraction and various mathematical proce-

dures, including algorithms. Proof practice includes the use of speech, gesture, notations and enhancement of mathematical concepts. To test the GEMC theory, a behavioral study was conducted with 120 undergraduate students. Participants were required to generate proofs for 2 mathematical tasks by thinking aloud facing an interactive whiteboard. Prior to starting the proof, participants performed either grounding actions (relevant to the task) or non-grounding actions (irrelevant to the task). For instance, in a task involving a triangle, the relevant action was to tap dots on the whiteboard that were symmetrically arranged, embodying the key concept of a triangle. Whereas the non-relevant actions included randomly tapping on small diamonds on the whiteboard without any conceptual connection. Participants performed better in generating mathematical insights when the grounded actions were used in addition to language when describing the proof. [9]

We tend to view both second language learning and mathematics as abstract domains of cognition. However, just as the body is used to learn words and their meanings, mathematical concepts are also learned through physical experiences. Increasing experimental evidence indicates that embodied strategies are foundational for improved understanding and learning in at least 2 educational domains: second language acquisition and mathematics. Utilizing the body, through actions and gestures, proves to be a strong tool for comprehending and learning academic subjects. In regards to other abstract domains like environmental sustainability there is ample opportunity to explore and test the theory of embodied cognition. [3]

2.1.3 Learning by Doing

Our world is constantly changing and practical, and we can only truly understand it through action. Or, to phrase it in terms familiar to anyone with even basic pedagogical knowledge: learning by doing. The person behind these words is the American philosopher, educator and social critic, John Dewey whose first pedagogical article “My Pedagogic Creed” dates back as late as 1887. His educational ideas about teaching and learning propose that practical problem solving and theoretical learning should be used in conjunction with each other for effective

learning to take place. This theory has since gained worldwide recognition among educators from different fields. [10]

In his essay *Democracy and Education*, John Dewey voiced his belief in education as a catalyst for social change. He viewed education as a means to support democracy by addressing economical injustices and achieving political objectives that would promote societal progression. We can therefore conclude that education is the result of Dewey's political beliefs in establishing a society where standard knowledge and social intelligence are equitably distributed among all. In his essay *Democracy and Education*, John Dewey voiced his belief in education as a catalyst for social change. He viewed education as a means to support democracy by addressing economical injustices and achieving political objectives that would promote societal progression. We can therefore conclude that education is the result of Dewey's political beliefs in establishing a society where standard knowledge and social intelligence are equitably distributed among all. He often described theoretical learning by passive reception used in traditional schools as "medieval". His main concern was the gap between a child's lived experiences and imposed notions that could create a divide between the child's innate abilities and knowledge, forcing them to conform to the requirements of formal schooling. In Dewey's theory of education, there is a strong connection between a child's existence and their experiences as a continuous process, which he views as the ultimate aim of education. In this sense, education has the potential to equip a child with social skills and without establishing this relationship, education is hollow.

Dewey believes that contact and the continuity of experience are inseparable. A child absorbs experiences from society through interaction, and these continuous encounters create environments. In these contexts, circumstances and surroundings interact with personal desires and goals, shaping one's existence. Teachers should value and guide these encounters, ensuring order and direction to the child's experiences, leading to the development of a well integrated personality. He uses the simple example of children's games, where they actively follow the rules to keep playing. Comparably, students partake in group class activities with the aim of completing a task. This learning process gives students the freedom to think and make judgments without the imposition of any predetermined rules.

This proposed teaching method however, must have a clear goal, understanding of the environment, and knowledge of previous experiences to facilitate reflection and analysis of issues and experiences that may occur. Such organized encounters transform an inclination into a plan of action. This theory puts the child at the center of the learning process as they find by doing, making their role infrangible. Allowing them to become active social participants who partake in social encounters because they are deeply involved in the learning process. [11]

Dewey's teaching approach was rooted in his progressive philosophy of Pragmatism, which asserts that all methods are based on direct experience. He believed that any information or knowledge is subjective because it is directly tied to the lived experiences of the individuals involved. According to him, learning takes place in tangible and meaningful contexts, driven by a child's spontaneous actions. His teaching techniques emphasized learning through tasks that were relevant to a child's life, often employing project-based (PjBL) or problem-based learning (PBL) approaches. A 2022 study sought to evaluate the impact of the Project-Based Learning (PjBL) model on enhancing secondary school students' creative thinking abilities in comparison to the direct instructional learning model. The experiment involved 50 secondary school students where 8 essay tests were administered to measure students' creative thinking skills, focusing on fluency, flexibility, originality, and elaboration. The study concluded that the (PjBL) model has a major effect on improving secondary school students' creative thinking skills. Another study evaluated the impact of Project-based learning (PjBL) on the writing skills of 9th grade students. The results demonstrated that PjBL had a notable positive impact on students' English writing skills and possibly enhanced critical thinking, communication, and creativity through collaborative efforts. [12]

A study conducted in 2015 aimed to explore the effectiveness of problem-based learning (PBL) in middle school classes, specifically focusing on at-risk female students' experiences. The research examined how key components of PBL affected students' learning process and self confidence. Students reported in post study interviews how PBL improved their ability to sort, list and solve problems more effectively by using real life examples. It also increased their involvement and participation in the classroom by facilitating group collaboration and sharing

of ideas. An overall increase in enjoyment and motivation levels was reported by students as PBL made learning more relevant and fun by connecting classroom activities to real-world problems. This raised students' interest in learning and provided a deeper understanding of the material being discussed, boosting their confidence in tackling challenging subjects. The supportive learning environment was particularly beneficial for at-risk females. The dynamic created by the teachers helped guide and foster a collaborative learning environment, enabling them to boost their confidence and academic performance. The belief in the effectiveness of PBL was strong among students, with many noting it as a beneficial approach to learning that could be applied to various aspects of life and not only at school. The study concludes that implementing PBL in middle schools can be a powerful strategy to improve educational outcomes especially for at-risk students, promoting a more engaging and supportive learning experience that aligns with their needs and interests. [13]

Another pragmatic study conducted in 2011 on Active learning techniques explored the effectiveness of various teaching methods, including lectures, demonstrations, discussions, and in-class activities. The research found that active teaching techniques, such as in-class activities, significantly enhance learning outcomes compared to traditional lecture methods. In-class activities resulted in the highest overall scores, indicating that these hands-on, engaging methods are more effective at deepening student understanding and retention of material. Conversely, lectures yielded the lowest overall scores, suggesting that passive learning techniques are less effective for promoting comprehensive learning. These findings highlight the importance of incorporating active learning strategies in educational settings to improve student engagement and performance. The study underscores the value of experiential learning, aligning with Dewey's educational philosophies that advocate for learning through direct experience and active participation. This approach not only aids in better absorption of information but also fosters critical thinking and problem-solving skills, making it a beneficial practice for both instructors and students. [14]

Teaching is a multifaceted task with factors such as student motivation and the teacher's relationship with students significantly impacting its effectiveness.

Therefore it is important to base the utilization of any teaching method on specific contexts. Ultimately, instructors must confidently determine which techniques to implement, considering the material and frequency of use. This tailored approach is likely the key to the effectiveness of any teaching technique. [15]

2.1.4 Habit Formation as a Behavioral Intervention

The word “Habit” in psychology refers to the process in which certain contexts automatically induce actions due to the activation of mental context–action associations learned from previous performances. Habitual behavior is controlled by an impulsive process, meaning it can be triggered with minimal cognitive effort, control, awareness, or intention. When a behavior shifts from being goal-directed to habitual, the starting of the action becomes driven by conscious processes rather than by context impulses. Thus, the regulation of habitual actions becomes independent of motivational or voluntary control. When encountering significant context, the urge to perform the habitual behavior automatically gets triggered, making alternative behavioral responses less available. [16]

The process of human habit formation is straightforward. To form a habit, a behavior must be consistently performed in the presence of a specific cue or a set of them, allowing the development of cue-behavior associations. In case of behaviors that are initially goal-directed, the process of the habit-formation is a transitional period where behavioral regulation changes from a calculated system to an impulsive system. This switch in systems generates an immediate and automatic action based solely on the activation of associative stores of knowledge.

Habit formation has garnered interest as a mechanism for maintaining behavior change since habitual behaviors are thought to resist fluctuations in conscious motivation. Once a behavior becomes a habit, it is more likely to persist even when an individual’s motivation decreases, ensuring more consistent adherence to desired actions or routines. [17] The implication of habit in behaviors has been studied in several domains including those related to health, media, as well as environmentally relevant actions. Various environmentally significant behaviors

are considered consistent, fixed, and repetitive. Researchers are increasingly focusing on understanding these patterns not in terms of deliberative processes, but as habits and routines embedded in everyday life. This shift in focus highlights the automaticity and contextual triggers that sustain these behaviors, suggesting that interventions aimed at promoting sustainable practices should consider the habitual nature of such actions. By leveraging insights into habit formation and disruption, strategies can be developed to encourage more sustainable behaviors to take place effectively. [18]

Despite the surprising scarcity of social practice analyses focused on domestic waste management, an increasing number of studies has explored the social practices related to paper use and disposal in the workplace. An ethnographic study explored the use of paper at a university administration office where paper recycling habits were found to be more complex and creative than the general categorizations that are associated with such practices like ‘printing’, ‘copying’, ‘reading’ or ‘writing’. Instead, paper was found to support and connect a range of specific working practices in ways that are not easily replaced by digitization. Examples included using hand-outs in meetings for ‘social coordination practices,’ post-it notes or hardcopy ‘to do’ lists for ‘remembering practices,’ sketches to aid in the creation of new ideas for ‘sketching practices,’ and bringing original documents to meetings for ‘verifying practices.’ This study emphasizes the need to understand the dynamics of routinely reproduced practices and how specific practices are interconnected with other elements. [19]

Similar conclusions were yielded from a 9-month participant observation of a construction company’s Environmental team where they attempted to change waste disposal practices by removing under-desk bins in offices. Although the team members had a strong commitment and were operating in a seemingly supportive organizational environment, the program was ultimately abandoned. This demonstrates how efforts to directly alter practices highlighted the connections between under-desk waste disposal and other practices, such as waste removal by contracted cleaners, professional and normative standards like privacy, local regulations including health and safety, and even social interactions. [20]

Psychological research on the habitual nature of waste disposal and recycling behaviors is derived from predictive studies that quantify the influence of habit on these behaviors. Typically, these studies use past behavior as an indicator of habit, though from a psychological standpoint, merely measuring behavioral frequency does not differentiate habitual from non-habitual repetition. Despite this limitation, such studies have shown the consistency of waste management behaviors over time. A study published in 2010 found a correlation between the self-reported proportion of household waste recycled over the previous three months and the proportion recycled over the following two weeks, indicating fixed repetitive recycling patterns. [21]

Psychologists argue that because waste disposal decisions are typically made in consistent environments—such as at home on the day before the recycling bin is picked up—repetitive behavior in these contexts is likely to result in habit formation. This implies that habitual recycling is driven by the repetitive nature of the task in a familiar context, reinforcing the behavior over time. Correlational studies propose that recycling, when it becomes habitual, is driven less by planned decision making and more by unconscious activation.

An intervention study was conducted in which cameras were installed in the lids of household refuse bins. After viewing the footage, residents reported a decrease in waste disposal and an increase in recycling. This change was attributed to an increased awareness of their waste disposal habits rather than a shift in their perspective or intentions. This implies that the intervention led to a change in behavior by breaking habitual waste disposal patterns. A study discovered a negative correlation between lacking a recycling habit and engaging in recycling behavior [22]. The authors concluded that the established habit of waste disposal might hinder both the practice of recycling and the development of recycling habits in the future.

There is strong evidence supporting the idea of conceptualizing climate mitigation behaviors in terms of the habitual and routine parts of daily life, rather than solely as the result of deliberate thought processes. Both the social psychological literature, which characterizes 'habits' as impulsive, cue-driven behaviors, and

the sociological literature, which focuses on established social practices, provide valuable insights for designing interventions. There's a growing body of literature that highlights the significance of comprehending the habitual aspects of various behavioral practices, including but not limited to waste management. Interventions that integrate elements from both may be the most effective in challenging the ordinary habitual actions that pose threats to the global climate. [23]

2.1.5 Community Building

Community-level action for sustainable development has become a crucial scale of intervention in addressing the numerous urgent environmental issues. The community serves as both a platform and a support network for empowering those who aim to tackle environmental issues. Established communities possess a sense of place, which has become a defining feature of sustainable communities. Sustainable development projects aim to enhance this sense of place.

Numerous writers have investigated the significance of place and sense of place, building on the foundational work of early scholars in human geography. This discussion has expanded to encompass dialogue about the livability, quality of life, and the sustainability of human communities. Debord argues that the diminishing sense of place is central to our ecological crisis. A strong sense of place is a necessary condition for implementing sustainable development.

Since the widespread recognition of sustainable development in 1987, the discourse around it has evolved significantly. Initially, sustainable development was viewed in a goal-oriented manner, but has since shifted to a movement that is more process-oriented. As argued by Holling, sustainability can be defined as the capacity to examine, build, and sustain adaptive abilities. While the term development refers to the process of examining, building and sustaining opportunities. By combining the two terms, 'sustainable development' thus refers to the goal of cultivating adaptive abilities and building opportunities. Making it a concept that illustrates a clear collaboration. [24]

Viewing sustainable development as a process rather than a goal demands ongoing programs of observation and adaptation. Each successful adaptation serves

as a temporary response to the evolving of particular conditions. Briefly put, sustainable development is an ever changing target. Certain instances will require prolonged time frames to the extent of being indefinite. This occurs due to the unpredictable nature of adaptive systems and changes led by human innovation. By adopting this approach to sustainable development, there is a shift from replicating sustainable models to embracing self-organizational models, which are more suitable for communities. Such adaptive models can achieve higher success rates as they allow organic development of sustainable behavior in manageable steps. Instead of enforcing norms in advance they will evolve naturally as part of an adaptive response. [25]

Rather than being seen as a final goal, sustainable development must be approached as a process of change that is ever evolving. As a result of this shift, adaptability, innovation, and resilience clarify why the early environmental movement's focus on returning to a simpler time was not a successful strategy. In order to build sustainable communities it is necessary to have the capacity to accept change as well as the tools to address it.

2.2. Sri Lanka Case Studies

With global industrial development and population growth, plastic waste is being generated and released into the environment at an accelerating rate. Consequently, it is essential to discard plastic waste cautiously and effectively in order to mitigate its negative impact on the environment. Poor waste management leads to many animals ingesting plastic waste, a problem frequently highlighted in the media. Animals including elephants, sea turtles, and fish suffer from indigestion due to the accumulation of plastic waste like bags and wrappers subsequently leading to the accumulation of microplastics and other toxins in their bodies. This is then passed through the food chain, transferring the toxins to other animals as well as humans making it crucial to introduce sustainable disposal methods of plastic. [26]

In Sri Lanka, plastic waste is typically recycled, burned or shipped to municipal council landfills. However, during the COVID-19 pandemic, the disruption of

waste management processes led to a significant increase in plastic waste burning. The community's behavioral patterns have changed considerably since then making it crucial to implement appropriate waste management processes to address the current challenges effectively. [27]

The environmental perceptions that young children gain during early childhood form a foundation for their overall development. Research indicates that without fostering respect and care for the environment at a young age, children may never develop these attitudes later in life. Consequently, it is crucial for primary caregivers and educators to evaluate and enhance the quality as well as frequency of interactions between children and their environment. However, there is a notable lack of research on children's environmental awareness in the Sri Lankan context. A 2014 study examined the practices and attitudes of Sri Lankan preschool children regarding environmental protection, providing insights into early childhood engagement with sustainability. Many preschool children show a basic understanding of environmental issues, primarily influenced by their parents and teachers. Stories, activities, and discussions at home and school contribute to their awareness. The study found that children generally exhibit positive attitudes toward nature and express a desire to protect the environment. They often view nature as something to be cared for and respected by engaging in simple environmental practices such as picking up litter, recycling paper and plastic, saving water, and turning off lights to conserve energy which are often encouraged by adults in their lives.

This highlights the importance of early environmental education and the influential roles of parents and teachers in shaping young children's attitudes and practices regarding environmental protection. By fostering positive attitudes and sustainable practices from a young age, there is potential to cultivate a generation more committed to environmental protection. Some of the challenges pointed out in the research include inconsistent reinforcement of environmental practices at home and school and limited resources for comprehensive environmental education suggesting that an increase in interactive and participatory activities such as gardening, nature walks, and recycling projects can be particularly effective in strengthening children's environmental consciousness. [28]

The issue of sedentary behavior among primary school children is another rising concern within education, with rates steadily increasing globally, including in Sri Lanka. Physical activity interventions within classroom settings are recognized as essential for increasing students' movement behaviors while simultaneously enhancing their academic achievement and health. However, the demanding curriculum and educational pressures often promote more sedentary classroom behavior. A study aimed at developing and evaluating in-classroom physical activity breaks (IcPAB) for fifth graders in Sri Lanka yielded overall positive results. Students in the intervention group showed a significant increase in daily physical activity compared to the control group with measurable improvements in fitness levels, including endurance and strength. Teachers noted enhancements in student engagement and attentiveness during lessons following the physical activity breaks. A decrease in disruptive behaviors in the classroom was also reported, contributing to a healthier learning environment. Students in the intervention group demonstrated slight improvements in academic performance, particularly in subjects requiring higher levels of concentration. The positive outcomes suggest that such interventions can be feasibly integrated into the school curriculum and can provide significant benefits for students' overall development. Future studies may focus on long-term impacts and scalability across different educational settings. [29]

Another study explored the community awareness and perceptions regarding microplastics in Sri Lanka, revealing key insights into public knowledge and attitudes toward this environmental issue. The study found that awareness of microplastics among the Sri Lankan community varies widely. While some individuals are informed about the presence and impact of microplastics, a significant portion of the population lacks comprehensive understanding. Those aware of microplastics generally perceive them as a serious environmental and health threat. Some of the concerns raised include the ingestion of microplastics by marine life and the potential health risks to humans through the food chain. It was also determined that the primary sources of information on microplastics for individuals are media outlets, educational programs, and community initiatives. However, there is a need for more targeted and widespread educational campaigns to enhance understanding. The study also found that awareness of microplastics influences certain behavioral changes, such as reduced use of single-use plastics and increased

interest in recycling. Nonetheless, broader behavioral shifts are limited by a lack of accessible alternatives and infrastructure. The authors concluded that enhancing public education on microplastics, improving waste management infrastructure, and promoting sustainable practices can significantly impact reducing plastic pollution. Collaborative efforts between the government, non-governmental organizations, and community groups are crucial for effective intervention. [30]

By leveraging the outcomes of the explored intervention methods, Sri Lanka is able to increase its environmental sustainability advancing towards global standards. The suggested advancements from the studies include an increase in public awareness and a shift in the educational approach with regards to fostering sustainable habits like recycling in children. With focused efforts and international collaboration, Sri Lanka can effectively tackle its plastic waste management issues and potentially become a global leader in sustainable waste practices.

2.3. Research Question and Hypothesis

This chapter dissects the gaps found in the discussed literature. It will also address the articulated research questions and the corresponding hypothesis that guided the remainder of this study. The investigation is primarily driven to understand the effectiveness of embodied learning in relation to habit formation in children, with a secondary focus on the sustainability of this method for educators within the cultural context of Sri Lanka.

2.3.1 Identified Opportunities

By fostering respect and care for the environment from an early age, children are more likely to develop positive sustainable traits in the future. Caregivers and educators are encouraged to constantly assess and improve interactions children have with their environment. Studies suggest that by increasing interactive activities and reinforcing environmental practices, children are able to become more environmentally conscious. However, there is a lack of research that explores the process of environmental sustainability education, experience and awareness level that children in Sri Lanka possess.

Moreover, researchers have concluded that awareness, interaction and education can impact the progression of environmental sustainable development suggesting a strong link between them. Despite that not many studies have diverted their efforts to explore the link between educational tools and behavioral changes or habit formation specifically in the context of recycling making it another critical research gap.

2.3.2 Research Questions

1. How does using embodied learning methods affect the learning process of elementary school students?
2. How can educators utilize embodied learning methods as a catalyst to prompt sustainable behavior in students?

2.3.3 Hypothesis

Assumed cause

Embodied learning

Assumed effect

Habit formation/ Behavioral change

Hypothesis

By using embodied learning methods educators are able to trigger sustainable habitual change in elementary students when it comes to recycling.

Chapter 3

Research Design

This chapter presents the foundational principles and strategies used in this research, with detailed discussions on the research field, stakeholders, action cycle as well as the evaluation methods to be utilized.

3.1. Research Field

The project was initiated to address the increasing concerns regarding hazardous waste disposal methods specifically in the city of Kandy, Sri Lanka. The workshops were conducted at Vimallabudhi School, a primary educational institution committed to fostering environmental awareness among its students. The school was chosen due to its proactive approach to sustainability and its willingness to integrate innovative teaching methods into the curriculum. The focus was on elementary students, as this age group is highly receptive to new concepts and are capable of influencing their environment, including their homes and communities.

3.2. Stakeholders

Identifying and engaging stakeholders was crucial for the success of this project. Key stakeholders included:

1. Students: The primary beneficiaries of the workshops, whose engagement and feedback were pivotal in assessing the effectiveness of the activities.

2. Teachers: Collaborated in workshop delivery and provided insights into student behavior and learning needs.
3. School Administrators: Provided logistical support and helped integrate the workshops into the school schedule.
4. Parents: Encouraged to support their children's learning at home, thereby reinforcing the workshop themes.
5. Japan International Cooperation Agency (JICA) - Funding and sponsoring of the project
6. University of the Sacred Heart (USH) - Students from the USH assisted in facilitating the workshops and designing the icebreaker sections of the workshops.
7. University of Peradeniya (UP) - Members from the UP assisted in translating instructions into Sinhala when necessary as well as providing local support whenever needed.

3.3. Action Cycle Overview

The Action Cycle provides a structured methodology for implementing and evaluating the educational interventions aimed at fostering environmental awareness and sustainable habits among elementary students in Kandy, Sri Lanka. This cycle consists of four phases: organizing, acting, observing, and reflecting. The research includes two distinct action cycles, each with these four phases.

The first action cycle is dedicated to enhancing the participants' capacity and knowledge through embodied learning methods. The second action cycle concentrates on involving and supporting the local community to achieve the overall goal of the project of creating a model school for sustainability in the region.

3.4. Methodology

This section briefly revisits the research aim and associated research questions. Based on insights from the literature review, a framework will be proposed to address these questions. This will be followed by a detailed discussion of the research philosophy, approach, and design strategy. The chapter will conclude with an overview of the data collection and analysis methods.

The main aim of the research was to introduce embodied learning methods to educators in Sri Lanka, with the goal of fostering sustainable behavior changes, such as recycling, in elementary school students.

(a) How does using embodied learning methods affect the learning process of elementary school students? (b) How can educators utilize embodied learning methods as a catalyst to prompt sustainable behavior in students?

3.4.1 Research Philosophy

The applied research philosophy of this qualitative research methodology is interpretivism. This philosophy operates under the premise that reality is subjective, varied, and shaped by social factors. It suggests that comprehending someone's reality requires understanding it through their unique experiences, which can differ from others' due to their personal and social backgrounds. Interpretive methodologies center on inquiry and observation to find or construct a comprehensive understanding of the examined subject.

Opting for this philosophy the author was able to understand the individual and subjective experience of the local educators/teachers involved by utilizing the qualitative methods proposed in this philosophy. The methods include various techniques, like conducting in depth interviews, engaging in participant observation within specific settings and utilizing the researcher as a tool in the process.

3.4.2 Research Approach

According to literature, the selection of research methods whether qualitative, quantitative, or mixed must be guided by several considerations, including the nature of the research question, the availability of data, and the suitability of the approach to the research context. Based on these factors the following was concluded:

1. The primary research question aimed to investigate the effectiveness of embodied learning in habit formation among children, with a secondary focus on the sustainability of this method for educators in Sri Lanka. Consequently, demanding the collection of primary data that enables the exploration and development of new theories.
2. The author conducted onsite visits twice, in August of 2022 and March of 2023, collecting first hand primary data consistent with qualitative methods.
3. The research is concentrated on Sri Lanka's cultural context, requiring in-depth examination of the daily routines and challenges encountered by individuals, which could not be captured through quantitative methods. [31]

While the selected research method offers valuable insights, it is important to acknowledge potential biases. The method may be influenced by the subjective interpretations of the author, the specific cultural context of Sri Lanka, and the limited scope of qualitative data, which might not fully capture individual experiences. In an effort to mitigate these biases, the author strategically selected multiple tools including interviews, surveys and observational note taking. However they remain a consideration in the analysis and interpretation of the findings.

3.4.3 Research Strategy/Design

Considering the need for an in-depth examination of the cultural context, the individuals involved, and the activities presented, a case study research strategy appears to be the most appropriate to the author. Moreover, the nature of case studies strategy seems to lend itself to qualitative methods. [32]

3.4.4 Data Collection Method

In order to answer the primary research question, observational notes (in regards to children's participation) will be taken during and after the workshop. Whereas, comprehensive interviews will be conducted with the relevant participants to address the secondary research question.

3.4.5 Data Analysis Method

Thematic analysis focuses on the coding and organizing the content of the data into key themes. It can be used for this research to identify and interpret key themes related to the implementation and impact of embodied learning methods on promoting sustainable behaviors. By analyzing qualitative data from observations and interviews, thematic analysis can help uncover patterns and insights regarding the following themes:

1. Student Engagement - Identifying how students engage with and respond to the proposed methods and design.
2. Educators Perceptions - Understanding teachers' attitudes, beliefs, and experiences with embodied learning methods.
3. Behavioral Changes - Exploring evidence of changes in students habits and attitudes towards recycling and sustainability
4. Challenges and Opportunities - Highlighting any obstacles educators face with the proposed methods. Finding potential opportunities for improving the effectiveness of embodied learning approaches.

By systematically coding and categorizing the data, the author can draw meaningful conclusions and provide recommendations for educators and policymakers to enhance sustainability education in Sri Lanka.

Chapter 4

Action Cycle

The Action Cycle is a critical component of this research, providing a structured methodology for implementing and assessing interventions within the educational context of Vimallabudhi School. This chapter will delve into the stages of the Action Cycle, providing a comprehensive overview of the strategies and methodologies utilized. The planning phase encompasses the initial design and objectives of the workshops. The acting phase describes the implementation of these workshops in the classroom setting. The observing phase focuses on the data collection methods used to assess student engagement and learning outcomes. Finally, the reflecting phase involves the analysis and interpretation of this data to inform future iterations of the workshops.

4.1. Action 1 - Capacity Building

4.1.1 Planning and Organizing

In this action planning phase the foundational groundwork for the educational interventions is laid out. It involves identifying the objectives, designing the content, and organizing the logistics necessary for the successful implementation of the workshops at Vimallabudhi School.

Identifying Objectives

The primary objective of the workshops was to enhance students' understanding of sustainable actions like recycling and provide an outlet for them to practice such actions. To achieve this, specific learning outcomes were defined, aligning with both the educational standards of Vimallabudhi School and the broader goals of

the research. These outcomes included:

1. Critical Thinking: Encouraging students to analyze and evaluate information critically.
2. Creativity: Providing opportunities for students to express their ideas and innovate.
3. Collaboration: Promoting teamwork and effective communication among students.

Designing the Content

With the objectives clearly defined, the next step was to design the content of the workshops. This involved selecting appropriate themes and activities that would engage students and facilitate the desired learning outcomes. The content was developed to be age-appropriate and culturally relevant. Key considerations included:

1. Interactive Activities: Incorporating hands-on activities that promote active learning.
2. Multimodal Resources: Utilizing a variety of resources such as videos, games, and art supplies to cater to different learning styles.
3. Scaffolded Learning: Structuring the workshops to build on prior knowledge and progressively challenge students.
4. Facilitator Training: Preparing facilitators through training sessions to ensure they were equipped to support the workshops effectively and adapt to the dynamic environment.

Risk Assessment and Mitigation

An essential aspect of the planning phase was to anticipate potential challenges and develop strategies to address them. This included:

1. Identifying Risks: Potential issues such as lack of student engagement, resource constraints, or unforeseen disruptions.

2. Mitigation Strategies: Developing contingency plans, such as alternative activities, additional resources, and flexibility in workshop delivery to accommodate various scenarios.

Stakeholder Involvement

Engaging stakeholders, such as teachers, parents, and school administrators, was vital for the success of the workshops. This process involved maintaining open communication to keep stakeholders informed about the workshops' objectives, content, and schedule. Additionally, collecting feedback from these stakeholders helped refine the workshop design to ensure it aligned with the needs and expectations of the school community.

Organizing Logistics

Effective planning also requires meticulous attention to logistical details to ensure smooth execution. This included:

1. Scheduling: Coordinating with school administrators to integrate the workshops into the existing timetable without disrupting regular classes.
2. Resource Allocation: Ensuring that all necessary materials were available and accessible.

In summary, the planning phase set the stage for the successful implementation of the workshops by establishing clear objectives, designing engaging content, organizing logistics, assessing risks, and involving key stakeholders. The thorough preparation during this phase was instrumental in creating a structured and effective learning environment that would support the educational development of the students at Vimallabudhi School.

4.1.2 Workshop Conduction

The acting phase marks the implementation of the planned workshops, where theoretical designs are put into practice to observe their real-world impact. This phase involves the direct engagement with students and the facilitation of activities as outlined in the planning phase. The initial visit occurred in August

2024, during which the author conducted a three-day series of workshops. This first implementation aimed to translate the planned activities into practice, engaging students in a structured yet dynamic learning environment. A detailed explanation of each workshop day and its activities is discussed in this chapter.

Workshop Day 1

The first workshop took place on August 18, 2023, from 10:00 am to 12:00 pm at Vimalabuddhi School, centered around the theme of waste segregation. The author facilitated the session, with assistance from students of the University of the Sacred Heart (USH) and local teachers/volunteers from the University of Peradeniya (UP), who primarily translated instructions into Sinhala when needed. A total of 70 elementary students participated in the workshop.

Introduction and Icebreaker

Material - Folded pieces of paper numbered from one to ten.

Content - The students were divided into 7 groups with 10 members each and then handed a piece of paper. Following that they were each asked to introduce themselves numerically including the facilitators in their group.

Purpose - This icebreaker focused on the introduction of the facilitators to their respective teams and vice versa.

Activity One - Scavenger Hunt

Material - Different waste material around the school premises like plastic bottles, glass bottles, metal cans, paper bags, and food scraps like coconut shells.

Content - The students were divided into 7 groups with 10 members. Each group was then assisted individually by two supporting facilitators to the outdoor playing field where they proceeded to locate the cross marked hidden waste just as shown in figure 4.1.



Figure 4.1 Marked waste in the school playground

Purpose - The first aim of this activity was to allow students to physically touch and identify the material in order to support their theoretical knowledge of the item. Another goal was to emphasize the non-sedentary nature of this learning process and ensure the children felt relaxed.

Theoretical Session

Material - Slides that represent examples of the different types of waste. (i.e, plastic waste, glass waste, wood waste, metal waste, and paper waste).

Content - Following the previous activity, the students were directed back indoors where the author proceeded to display visual digital samples of the different waste categories. This was done while engaging with the students through questioning.

Purpose - The purpose of this section was to reinforce the theoretical concepts to support the physical interaction achieved in the previous activity. While also allowing the student to cool down from the physical exertion.

Activity Two - Relay Race

Material - Waste material collected by students in the first activity.



Figure 4.2 Local teachers holding different waste signs

Content - The local teachers were asked to hold up signs that represent each category of waste while standing in the outdoor playground. Students were then instructed to hand over the waste that mirrored the sign held by the teacher as shown above in figure 4.2 to one another in a relay format.

Purpose - To allow students to physically segregate the waste into the designated spot reinforcing the theoretical part explored previously. Allow students to engage with the teachers in a fun and non-formal environment.

Homework - Waste collection

Content - The students were instructed to collect plastic bottles and any other form of plastic waste they had used outside of the school premises for the next day's activity.

Purpose - The main purpose of this homework was to encourage engagement pertaining to waste segregation between the students and their parents. This also aimed to connect the learning within the school premises to their daily lives, encouraging learning beyond the classroom.

Workshop Day 2

The second workshop took place on August 19, 2023, from 10:00 am to 12:00 pm at Vimalabuddhi School. This session centered on the 3 R's concept (Reduce, Reuse, Recycle). The author facilitated the workshop with the same team and students as the previous session.

Icebreaker

Material - Paper and Pens.

Content - Using signs with different words written on a paper, students were asked to count the number of letters it has. Following that they used the number of letters in the word to create groups (ex. R-E-C-Y-C-L-I-N-G with 13 letters, 13 members in a group). Progressively the number of letters in the words became less, creating 10 groups of 7 members.

Purpose - The purpose of the activity was to teach the children how to pronounce specific words and to develop their analytical skills through counting and organizing into groups.

Theoretical Sessions

Material - Slides with examples of the 3 R's (Reduce, Reuse, Recycle).

Content - Using digital and physical examples of the 3 R's, the author encouraged discussion.

Purpose - This activity aimed to introduce the concept of 3 R's before utilizing them in the following activities.

Activity One - Drawing Session

Material - Papers, pens, markers and different coloring materials.

Content - In their respective group, students were encouraged to draw items they can reuse or recycle from waste. Some examples are shown in figure 4.3.

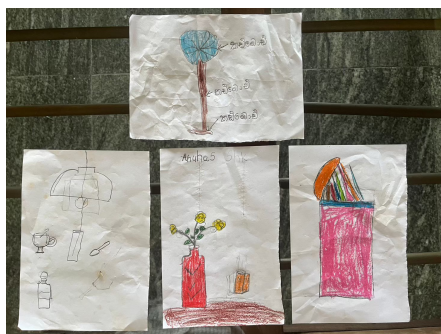


Figure 4.3 Drawings made by some students during the session

Purpose - The aim of this activity was to provide students with a creative outlet to express their ideas based on the previously introduced theory, and to test if the concepts resonated with them.

Activity Two - Eco Bricks

Material - Collected plastic bottles and waste from the students homework.

Content - From the material collected, each group was handed a single 2 liter plastic bottle which they had to fill up with tiny pieces of other plastic waste as shown in figure 4.4. Once tightly filled up, all seven bottles were tapped together to form a small eco brick as shown in figure 4.5.



Figure 4.4 Students filling the plastic bottles



Figure 4.5 Eco Brick made by combining students work

Purpose - The primary purpose of this activity was to empower the students by guiding them in creating something they could use collectively. Additionally, it was crucial to provide a tangible example of the 3 R's concept by having them actively engage in it.

Workshop Day 3

The final workshop took place on August 21, 2023, from 10:00 am to 12:00 pm at the University of Peradeniya (UP). The theme of the workshop was Leadership. The author facilitated the session, with assistance from students of the University of the Sacred Heart (USH) and local teachers/volunteers from the University of Peradeniya (UP), who primarily translated instructions into Sinhala when needed. A total of 12 elementary students were picked to participate in this workshop. These 12 students were then assigned as the first members of the school's eco club.

Icebreaker

Material - Print out worksheets of the 30 circles exercise.

Content - 12 students who were selected by the teachers as the leaders of the eco club split up into 4 groups. Each group member was handed a worksheet to fill within 5 minutes. After that, students introduced themselves and picked one of the drawings to briefly talk about.

Purpose - To help the students and facilitators warm up and become familiar with each other.

Activity One - Who is a good leader?

Material - Print out of worksheets and pens.

Content - After briefly discussing the definition of a leader using digital slides, the students were handed a worksheet to fill out with the support of the facilitators and local teachers. An example of students work is shown in figure 4.6

Purpose - This activity aimed to encourage the students to think independently and relate the learning material to their daily lives, while empowering them to speak and voice their opinions publicly in front of others.

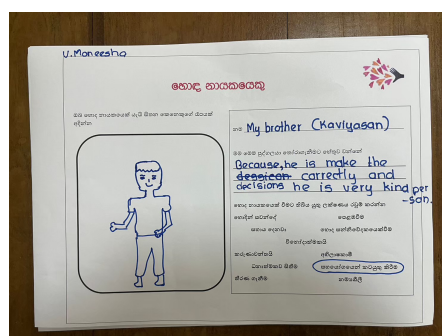


Figure 4.6 Leadership worksheet filled by student



Figure 4.7 Winning teams paper tower

Activity Two - Paper Tower

Material - Collected used/scraps of paper.

Content - Each group was provided with equal amounts of paper. They were then instructed to create the longest standing tower within 2 minutes just like the one shown in figure 4.7. After the first round they were given 2 minutes of reflection where they could discuss their strategy for the final round.

Purpose - The activity's goal was to improve the children's collaborative skills and critical thinking skills while working with each other.

Activity Three - The "I can" Attitude

Material - Printed worksheets.

Content - The worksheet handed to the students contained two parts, the first being a crossword puzzle with affirmative positive words like strong, brave, confident etc. While the second worksheet was more personal as students had to

fill their own individual goals.

Purpose - The goal of this activity was to cultivate a positive thinking attitude in children by encouraging self-belief using affirmative wording.

Activity Four - Vision Board

Material -Magazine scraps, color paper, scissors and pens.

Content - Using the materials provided, the students were encouraged to individually express themselves by creating a collage they took home with them.

Purpose - To inspire the students to think creatively and boldly about their future and goals they would like to achieve. Create a tangible item that represents their experience in the workshop as a reminder of their participation.

To conclude the first acting phase, the author focused on several key points while designing the workshop. These included implementing embodied learning with sufficient guidance and instructions to facilitate understanding, incorporating tangible items to help students connect their learning to their everyday lives, and involving various community members to accelerate and sustain the students' learning process. These elements were crucial in ensuring that the workshops were not only educational but also practical and engaging for the students.

4.1.3 Observation and Reflection

Workshop Day 1 Reflection

Survey

According to the survey conducted after the workshops, most facilitators agreed that the scavenger hunt activity had the most impact during the first workshop. They noted that the activity encouraged children to collaborate in finding various pieces of trash hidden around the playground. One facilitator also mentioned that they could feel the students' energy and enthusiasm for learning during this specific activity.

Observations

During the scavenger hunt activity, the author moved around with different groups to observe their efforts in finding the hidden waste. Some groups dispersed individually around various areas of the playground, while others stayed together.

When items were found, some students initially just wanted to dispose of them back in the playground until they were specifically instructed to place them in a designated pile.

In the theoretical session, some students seemed to connect the activity they had previously played to the material being explained. For instance, one of the students referred to an item he collected in the scavenger hunt when asked to give an example of plastic waste.

During the relay race the author noted how students engaged in conversations to discuss the waste category of the items they were handling regardless of team affiliations. Some students even returned to the pile after the game was concluded to ensure proper waste segregation

Workshop Day 2 Reflection

Survey

The facilitators unanimously voted the eco-brick activity as the most memorable part of the second workshop. They attributed this to the sense of accomplishment their group felt upon seeing the assembled chair. Additionally, they noted the impressive focus and engagement of the students during the task. One facilitator highlighted how this activity allowed for more effective interaction with the children, as their concentration facilitated meaningful conversations about sustainability among their group.

Observations

The first observation made by the author on the second day was the excitement the students came in holding their homework. Approximately half of the students showed up with plastic bottles and plastic waste from home, some who did not bring in any material with them started collecting what they could find in the classroom or playground.

During the drawing section students' responses varied significantly. Some appeared distracted and left the classroom to do other activities. Those who stayed engaged with the drawing frequently referred to the digital examples provided and simply replicated them. However, the older students demonstrated notable

creativity, coming up with unique drawings and innovative ideas on how to utilize different waste materials.

The students were highly engaged with one another during the eco-brick activity, cutting up plastic pieces and filling plastic bottles. Some even searched for additional bottles to fill. When the chair made from the eco-bricks was assembled, the students eagerly volunteered to interact with it, whether by touching, holding, or sitting on it.

Workshop Day 3 Reflection

Survey

Half of the facilitators identified the worksheet activity as the most effective during the third workshop, while the other half agreed on the paper tower activity. Those who favored the worksheet activity explained that it was intellectually stimulating for the students, providing an opportunity for them to think critically about the leadership. Whereas, according to one facilitator, the paper tower activity fostered collaboration and trust among the students, helping them develop leadership skills.

Observations

During the icebreaker activity, the students demonstrated a lot of creativity, but they were extremely shy when asked to present their ideas. However, after completing the worksheet activity, the students seemed more confident when presenting. Some of them even voluntarily shared their answers.

Even though the worksheets were translated in Sinhala, some students struggle with understanding the content requesting assistance from the local participating teachers. However during the paper tower activity the students seemed to not require as much assistance, instead they engaged in understanding the content by physically testing the theories they had in mind. This activity in particular had students display their collaborative and analytical skills.

4.2. Action 2 - Community Support/Involvement

4.2.1 Planning and Organizing

The second action planning phase focuses on engaging and supporting the local community to achieve the project's goal of creating a model school for sustainability in the region. Central to this effort is the establishment of an Eco Club at Vimalabuddhi School. To ensure smooth operations for the second action cycle, the following steps were implemented:

Identifying Objectives

1. Defining clear objectives for the Eco Club, such as raising environmental awareness, promoting sustainable practices, and involving the community in environmental activities.
2. Establishing short and long-term goals to guide the club's activities and measure its success.

Structure and Membership

1. Developing a structure for the Eco Club, including roles and responsibilities for members, meeting schedules, and activity plans.
2. Recruiting members from among the students, teachers, and community volunteers, ensuring a diverse and inclusive group.

Curriculum and Activities

1. Designing a curriculum that incorporates interactive and hands-on activities related to environmental conservation, such as tree planting, recycling and energy-saving initiatives.
2. Planning regular meetings and events to engage the members and maintain the momentum of the club.

Partnerships and Support

1. Establishing partnerships with local environmental organizations, government agencies, and businesses to provide expertise, resources, and funding for the Eco Club's activities.
2. Seeking support from the school administration and the broader community to ensure the sustainability of the club.

Communication and Promotion

1. Developing a communication strategy to promote the Eco Club within the school as well as the wider community.
2. Creating promotional materials, such as flyers and social media posts, to attract members and raise awareness about the club's activities and goals.

By planning the establishment of the Eco Club, the second action cycle aims to foster a culture of environmental supervision within the school and the community, ensuring the sustainability of the project's impact.

4.2.2 Eco Club Establishment

This phase of the cycle involves the practical implementation of the plans made for establishing the Eco Club at Vimalabuddhi School. It mainly focuses on bringing the Eco Club to life and engaging students, teachers, and the community in environmental activities.

Workshops Led by Locals

As part of the second action cycle, workshops run by local teachers and community members play a crucial role in embedding sustainable practices and environmental awareness within the school community. This section outlines the implementation of these workshops, focusing on empowering locals to lead and sustain the educational initiatives.

To prepare local facilitators to lead the workshops, training sessions were conducted for teachers and community members, equipping them with the necessary skills and knowledge. Facilitators were provided with resources and materials, including activity guides and informational handouts, to support their efforts.

Ensuring that facilitators were comfortable with the workshop content and confident in their ability to engage and educate students was a crucial aspect of the training process. Following the training, collaboration with local facilitators took place to design the workshop schedule and content, ensuring alignment with the goals of the Eco Club and the overall project. The workshops focused on practical, hands-on activities that reinforce the concepts of environmental conservation and sustainability, incorporating culturally relevant examples and practices to make the sessions more relatable and impactful for the students.

The workshops were then conducted according to the planned schedule, with local facilitators leading the sessions and engaging students in interactive learning activities. A supportive and collaborative environment was fostered, encouraging students to ask questions, share ideas, and participate actively. The workshops were documented through photos and videos to gather insights for future improvements like refining the workshop content and delivery methods, ensuring they remained relevant and effective.

By empowering local community members to lead these workshops, the project aims to create a sustainable model of environmental education that can continue to thrive beyond the initial implementation phase. This approach not only enhances the capacity of the local community but also ensures the longevity and success of the sustainability initiatives within the school.

Official Launch

To establish the Eco Club, an official launch event was organized, inviting students, teachers, parents, and community members. During the event, the club's objectives, goals, and planned activities were introduced to the attendees, emphasizing the importance of environmental awareness and sustainable practices. Following the launch, the first official meeting of the Eco Club was held to establish roles and responsibilities among members. Different club officers were elected to lead and organize activities, and members were assigned specific tasks such as event planning, communications, and community outreach to ensure the club's smooth and effective operation.

Moreover, students who participated in the leadership workshop held in August 2023 were chosen as the main members of the club. These students will leverage their influence to actively recruit new members. To further enhance the club's activities and impact, partnerships were formed with local environmental organizations, government agencies, and businesses. Workshops and seminars on environmental topics were organized, with invited experts to speak and engage with club members. Additionally, parents and community members were involved in club activities to cultivate a sense of collective responsibility and action.

The progress of the Eco Club's activities and member participation is continuously monitored. Feedback is collected from members, teachers, and community participants to evaluate the effectiveness of the activities and identify areas for improvement. By effectively implementing these steps, the Eco Club aims to instill environmental awareness and sustainable habits among students, thereby fostering a model of sustainability within the school and the broader community.

4.2.3 Observation and Reflection

During the second visit the author noted a few differences in both the school environment as well as student behaviors. One of the most notable differences was the lack of waste around the school premises and the presence of awareness posters across classroom walls as shown in figure 4.8.

Another observation was the increased number of reusable water bottles instead of plastic bottles and presence of waste segregation bags in the student classrooms as shown in figure 4.9.

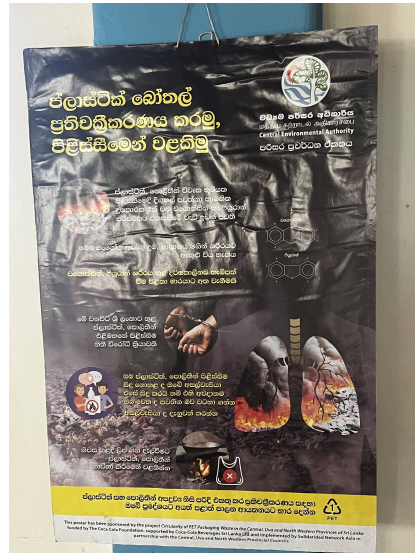


Figure 4.8 Poster placed in the main school hall



Figure 4.9 Burnable waste bin

Chapter 5

Results

This chapter presents the findings of the research, with a primary focus on a thematic review of the interviews conducted with local teachers. By analyzing these interviews, the study aims to uncover key insights and patterns related to the implementation as well as the impact of the workshops. The themes identified from the teachers' perspectives provide a deeper understanding of the effectiveness of the educational interventions and their influence on student learning and community engagement.

5.1. Traditional Teaching Methods in Sri Lanka

According to the interviewees, many teachers in Sri Lanka still rely heavily on traditional lecture methods, where the teacher speaks and students listen while taking notes. One of the interviewees spoke about two specific approaches, the “student-centered” and “teacher-centered” approach. She emphasized the importance of understanding and tailoring the teaching method to the students preferences. Another interviewee noted that primary school teachers tend to utilize activity- based learning where students engage in several activities like drawing, acting, and even practical site visits. However, there is a noticeable shift as students move to higher grades, where the focus moves more towards theoretical learning and preparation for board exams.

5.2. Embodied Learning

The interviewees reflected positively on the workshops conducted elaborating on how the learning methods utilized during the workshop were positively received

by the students. One interviewee spoke about how the students enjoyed the activities and showed a higher level of engagement and participation compared to traditional classroom settings. Aside from enjoyment, she also noted how some students demonstrated better understanding and retention of concepts taught during the workshops.

When discussing the adoption of embodied learning methods, one major challenge mentioned was the resistance from teachers in adopting such methods. Explaining that the success of student-centered and activity-based methods is also dependent on teachers' attitudes. Teachers who are supportive and proactive in implementing these methods tend to see better engagement and learning outcomes from their students. According to one of the interviewees, teachers perceive little benefit and face practical issues such as lack of resources (e.g., stationery for poor students). The need to adhere to a strict timeline in completing the dense curriculum was another major concern raised.

Despite these challenges, the interviewees expressed personal interest and commitment to implementing such programs if given the opportunity. Emphasizing on the need for support and resources to successfully integrate active learning methods into the school curriculum.

5.3. Behavioral Changes

Based on the interviewees observations, participating in the workshop showed a positive influence on the students behavior and attitudes in the area of environmental education. Students who engaged in the activities demonstrated better practices in waste segregation. A specific example mentioned was when students correctly disposed of milk packets given out during break times, showing they understood the importance of not littering. The interviewees concluded that the teachers' perceptions shifted towards considering methods to encourage lifelong learning behaviors.

Chapter 6

Discussion and Conclusion

This chapter presents a comprehensive analysis of the findings from the qualitative data, focusing on the current traditional teaching methods in Sri Lanka and the effects of implementing embodied learning approaches. By comparing the insights provided by the facilitators and observing the changes in both student and teacher behaviors, this discussion aims to explain the impact and challenges of these educational changes. Finally, the chapter concludes with a summary of the key findings and their implications, offering insights into the potential for sustainable educational reform in Sri Lanka.

6.1. Discussion

The discussion is structured to first analyze the effectiveness of student-centered activities in enhancing the learning process, followed by an exploration of the communication benefits and behavioral changes observed. The shift in teacher perceptions towards fostering lifelong learning behaviors is then examined, highlighting the gradual yet impactful nature of these changes. The challenges encountered in implementing these new methods and the persistent influence of the examination culture are also discussed.

6.1.1 Effectiveness of Embodied Learning Approach

The facilitators' unanimous agreement on the effectiveness of embodied learning approaches aligns with the broader educational research, which consistently highlights the benefits of active learning. Studies show that active learning increases student performance in science, engineering, and mathematics. Similarly, it was found that active learning methods, such as group work and problem-based learn-

ing, enhance understanding and retention of knowledge. The positive reception of hands-on activities, corroborates these findings, demonstrating that interactive methods engage students more effectively than traditional lectures.

Facilitators observed that using physical actions to convey concepts during activities helped overcome language barriers. This suggests that embodied learning can be particularly beneficial and effective in multilingual classrooms, where students might struggle with verbal instructions, making learning more accessible to all students. According to the facilitators and local teachers, students were more attentive and interactive when participating in the practical waste segregation activity compared to the theoretical session. Signifying that using embodied learning approaches can be particularly effective in maintaining students' attention and focus.

Students demonstrated strong recollection of the knowledge gained in the workshops after 6 months suggesting that embodied learning, which involves physical movement and sensory experiences, aids in memory retention and understanding. This supports the idea of cognition's being deeply rooted in the body's interaction with the world.

6.1.2 Observed Behavioral Changes

According to the psychologists, habits are formed through a loop of cue, routine, and reward. In the context of the workshops, the activities (routine) were linked to positive outcomes (rewards), such as a cleaner environment, which reinforced the desired behaviors. Local teachers observed that students developed positive habits as a result of the embodied learning activities. For example, students started properly disposing of milk packets and using personal water bottles instead of plastic ones. These behaviors indicate that the students not only understood the concepts but also integrated them into their daily routines. This demonstrates how embodied learning, which integrates physical movement and sensory experiences, aligns well with theories of habit formation. Additionally, the fact that students retained and practiced the behaviors learned during the workshops after six months could signify that the activities supported in establishing these habits.

As the research suggests repetition and reinforcement proved to be critical components of habit formation. The ongoing practice of proper waste disposal and the use of personal water bottles likely contributed to the solidification of these behaviors. The teacher's observation that students continued these practices long after the initial activities confirms the importance of consistent reinforcement in developing lasting habits.

Another significant outcome of the workshops was the shift in the local teachers' perceptions. Their willingness to consider and adopt new methods is essential for the long-term success of these initiatives. Shifting from a purely lecture-based approach to a more rounded view of education is a crucial step towards fostering desired habitual changes like sustainability in students.

6.1.3 Challenges and Considerations

Embodied learning approaches like any other heavily depend on teachers' willingness and ability to adopt these methods. Resistance from teachers accustomed to traditional methods pose significant barriers in the implementation of such an approach. Professional development and training programs are essential to equip teachers with the skills and confidence needed to incorporate embodied learning methods into their teaching practices.

The examination culture in Sri Lanka, as discussed by the teachers in the interviews, poses a significant challenge to the adoption of embodied learning approaches. The emphasis on exam preparation often leads to a reliance on traditional, theory-based learning, thereby limiting opportunities for innovative teaching methods that include practical and interactive learning experiences. Addressing this issue requires a systemic change in how student performance and learning is evaluated, potentially shifting towards more comprehensive assessment methods that value practical understanding and critical thinking skills.

While initial habit formation is promising, sustaining these behaviors requires continuous reinforcement. Teachers need to consistently model and encourage these practices to ensure they become ingrained. School policies and environments

should also support and promote these behaviors by providing adequate facilities for recycling.

This discussion highlights the significant benefits of embodied learning methods in not only enhancing student engagement, understanding, and application of knowledge but also fostering sustainable habits. The participants' observations and experiences are in line with established educational theories and research, reinforcing the value of interactive and experiential learning. However, the challenges of teacher resistance, and the pervasive examination culture stress the need for a more balanced and supportive approach to educational improvement.

6.2. Conclusion

By testing and analyzing the impact of embodied learning methods, the thesis has shown how embodied learning can prompt sustainable behavioral change in elementary school students. The integration of student-centered, activity-based learning methods in Sri Lankan classrooms has shown promising results in enhancing student engagement, understanding, and real-world application of knowledge. The facilitators' feedback and observations highlight the benefits of these methods, both for students and teachers. However, the entrenched examination culture and resistance to change among some teachers remain significant challenges.

To achieve broader adoption and sustained impact, educational reforms must address these barriers. Encouraging a gradual, step-by-step implementation approach appears to be a viable strategy for long-term success. Additionally, systemic changes in evaluation methods are necessary to support and reinforce the shift towards more interactive and practical learning experiences.

In conclusion, while the journey towards comprehensive educational reform is challenging and requires patience, the positive outcomes observed in these initial steps provide a strong foundation for future efforts. By continuing to promote and support embodied learning methods, Sri Lanka can move towards a more dynamic, engaging, and effective educational system that better prepares students for lifelong learning and real-world challenges.

6.3. Limitations

While this study provides valuable insights into the effectiveness of embodied learning methods in fostering sustainable habits among elementary school students in Sri Lanka, it is essential to acknowledge several limitations.

Generalizability and Data Collection Method

The research was conducted with a relatively small sample size, focusing on a single school and a limited number of students and teachers which could limit the generalizability of the findings to a broader population. The primary data collection methods involved interviews and observations, which can be inherently viewed as subjective.

Time Constraints

The research was conducted over a relatively short period. Although there were follow-up observations after six months, a longer-term study would be more effective in assessing the sustained impact of embodied learning on habit formation and behavioral changes. The absence of extensive longitudinal data makes it challenging to draw definitive conclusions about the long-term effectiveness and sustainability of the embodied learning methods.

External Factors

External factors such as school policies could impact the effectiveness of the embodied learning methods. These factors were not controlled in the study, making it difficult to isolate the impact of the learning methods alone.

By recognizing these limitations, the research emphasizes the need for future studies to address these constraints to help build a more comprehensive understanding of the impact of embodied learning methods on creating habitual changes in diverse educational contexts.

6.4. Future Works

To enhance community involvement, the Eco Club is hosting a sustainability-themed festival in August 2024 and inviting all community members to join.

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Appendices

A. Survey Questionnaire

Green Youth Workshop Survey

2024/06/19 18:25

Green Youth Workshop Survey

This survey includes question related to the workshops conducted at the Vimalabudhhi School in Sri Lanka on the 16th, 17th, & 19th of August 2023.

* Indicates required question

1. How organized was the workshop in your opinion? *

Mark only one oval.

12345

Not ☐ ☐ ☐ ☐ ☐ Well Organized

2. Which section of the first workshop was the most memorable from your experience? *

Mark only one oval.

☐ Scavenger Hunt

☐ Theory Section

☐ Relay Race

3. Why did you choose the above? *

https://docs.google.com/forms/u/1/d/1QU5njOzPOKxiMKx6DZEh_xRS7-1LTtyFRmpFZi6vP1o/printform

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Green Youth Workshop Survey

2024/06/19 18:25

4. Which section from the second workshop was the most memorable from your experience?

Mark only one oval.

- ☐ Theory Section
☐ Drawing Section
☐ Eco Bricks

5. Why did you choose the above? *

6. Which section from the three workshop was the most memorable from your experience? *

Mark only one oval.

- ☐ Leadership Worksheet
☐ Paper Tower
☐ Vision Board

7. Why did you choose the above? *

8. Do you think the students were able to understand the material despite the language barrier?

Mark only one oval.

- ☐ Yes
☐ No
☐ Somewhat

https://docs.google.com/forms/u/1/d/1QU5njOzPOKxiMKx6DZEh_xRS7-1L1TyFRmpFZi5vP1a/printform

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Green Youth Workshop Survey

2024/06/19 18:25

9. Do you think the physical activities helped the children understand the material of the workshop?

Mark only one oval.

- ☐ Yes
☐ No
☐ Somewhat

10. Please expand on why you choose the above. *

11. Which workshop out of the three was the most successful from your experience? *

Mark only one oval.

- ☐ Day 1
☐ Day 2
☐ Day 3

12. Please expand on why you choose the above. *

https://docs.google.com/forms/u/1/d/1QU5njOzPOKxiMKx6DZEh_xRS7-1L1TyFRmpFZi5vP1a/printform

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B. Research Ethics Committee Approval

2024 年 4 月 18 日
April 18th, 2024

慶應義塾大学大学院メディアデザイン研究科研究倫理委員会
審査結果通知書

Keio University Graduate School of Media Design
Research Ethics Committee
Result of Ethics Review

修士課程
Ms. AHMED EMAN
Master Program

倫理委員会委員長 稲落 正彦
Masa Inakage (Prof.), Chair
Keio University
Graduate School of Media Design
Research Ethics Committee



研究倫理審査申請のあった研究課題名『Use of Embodied Learning Methods for Environmental Sustainability Education in the Green Youth Project led by the JICA (Japan International Cooperation Agency), USH (University of Sacred Heart) & KEIO University team in Kandy, Sri Lanka』について、倫理委員会で審査した結果を次のとおり通知いたします。

We hereby inform you of the result of the ethics review conducted by the KMD Research Ethics Committee regarding the research proposal entitled "Use of Embodied Learning Methods for Environmental Sustainability Education in the Green Youth Project led by the JICA (Japan International Cooperation Agency), USH (University of Sacred Heart) & KEIO University team in Kandy, Sri Lanka" as follows:

審査結果：承認（2024 年 4 月 18 日付）
倫理審査番号（承認番号）：kmd-2024_E007

Result: Approved on April 18th, 2024
Ethical review number (approval number) : kmd-2024_E007

以上