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Changing children's awareness and behavior toward environmentally sustainable practices through educative programs

by

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Abstract

Education plays a valuable role in sustainable development if linked to behavior change. This research has evaluated environmental education effectiveness to change children's, teachers', and Sustainable Energy Development (SEDV) residents' awareness and behavior toward the impact that energy has on the environment. Implementing the Theory of Planned Behavior developed by Ajzen in 1990, questionnaires were designed with queries about attitude and perceived behavioral control as variables that most influence the intention to perform a behavior. Although learning may not produce rapid behavior change, it can be useful to motivate people to adopt the desired attitude and awareness. The findings demonstrated that elementary school students are capable to learn about energy and environment, and that the educative program impacted participants' attitudes and awareness favorably. Overall students and SEDV residents gained more knowledge about environmentally sustainable practices by engaging in environmental activities. Consequently, they acquired a stronger intention to portray pro-environmental behavior.

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4E:	Energy Efficiency Education Program
CAWST	Centre for Affordable Water and Sanitation Technology
DESD	Decade of Education for Sustainable Development
E2RP	Environment and Energy Residency Program
EE	Environmental Education
ES	Environmental Sustainability
ESD	Education for Sustainable Development
JEI	Junior Energy Inspector
JEP	Junior Energy Prosumer
JEST	Junior Energy Specialist Training
PBC	Perceived Behavioral Control
PEB	Pro-Environmental Behavior
SD	Sustainable Development
SEDV	Sustainable Energy Development
TPB	Theory of Planned Behavior
WCED	World Commission on Environment and Development

Chapter 1: Introduction

Many believe that human behavior reflected by human activities is the principal cause of the deteriorating environmental quality. The Earth provides us a safe place to inhabit but also finite natural resources to survive in it. Some of the resources, mostly used by humans, make energy generation possible. In the past centuries, wood was initially used as a renewable energy source. However, fossil fuels were discovered decades later, and after discovering the energy intensity of these non-renewable sources, their production was intensified. This strengthened the link between the environment and energy. The elevated level of extraction of those energy sources improved the economy of many countries but has impacted negatively the environment due to the growing population, affecting sustainability. However, those sustainability problems are the result of the repercussion of the lifestyles of billions of humans rather than rarely the result of malicious intent (Boeve-de Pauw, Gericke, Olsson, and Berglund, 2015).

To reach a better comprehension of the term sustainability, it has been widely recognized as the ability to satisfy our needs without jeopardizing the capacity of future generations to satisfy their needs (World Commission on Environment and Development [WCED] 1987, p. 39), and its achievement is based on safeguarding the environment while maintaining economic growth, and encouraging social equity at the same time (Portney, 2015). These three factors are also known as the three pillars of sustainability (World Commission on Environment and Development [WCED], 1987). Implementing these three aspects surges sustainable development (SD) as a strategic process focused on the continuing economy advance that provides support to citizens while preserving the viability of ecological systems (Bell & Cheung, (n.d.)). This study is focused on the environmental component.

According to the "Broadening Education" report by the World Commission on Environment and Development (1987), "sustainable development necessitates changes in values and attitudes towards the environment and development" (p. 111). Schultz (2011) argues that sustainable development (SD) is "a goal that can only be achieved by changing behavior" (p. 1). Nonetheless, the behavior of each citizen is a construct that for many

decades has been studied broadly in the social sciences, and even though scholars may not agree on the most relevant empirical model to explain its causation, there is still a large consensus that human behavior is correlated to psychological features of individuals, such as attitudes, behavior, awareness and knowledge (Boeve-de Pauw et al., 2015).

That is why the process of behavior change involves education. According to Irish Aid (2006), "The method that raises awareness and comprehension of this speedily changing, interdependent and unequal world is education… Searching to involve people in analysis, reflection, and promote citizenship and participation, locally and globally" (p. 9). Thus, education plays a central role of achieving changes in values and attitudes, always considering the responsibilities that are part of those changes. As stated by Boeve-de Pauw et al. (2015), "to reach a transition towards a sustainable future, critical ingredients for change at the level of individual citizens include a better understanding of, more positive attitudes towards, and behaviors in line with, the principles of SD" (p. 3).

Nowadays, it is manifested that environmental education (EE) is the main key to improving or changing students' thinking and acting in order to create and strengthen an environmentally prosperous future for all (De Leeuw & Valois, 2014). Nevertheless, it must go beyond implementing environmental education, as Ellefirtz and Rands (2009) found that the relationship between curricular events and the impact of those in changing attitudes and behavior on students is fragile. Therefore, it is crucial to obtain strong social and institutional support. Birnbaum (1988) considers that the culture toward sustainability of an institution sets boundaries that define the probability that people behave in specific ways.

1.1 The Research Question

Taking into consideration the previous review, the following research questions have emerged: What is the real effect obtained by the implementation of educative material to change:

- children's and teachers' awareness and behavior as receivers and;
- Sustainable Energy Development (SEDV) residents and facilitators as the knowledge deliverers, toward energy's effect on the environment?

Also, how does this implementation contribute to developing SEDV residents' and facilitators' leadership qualities?

1.2 Objectives

The primary goal of the present study is to evaluate the effectiveness of environmental education workshops on changing children's and teachers' awareness and behavior toward energy's impact on the environment by receiving those workshops, and SEDV residents and facilitators by delivering those workshops. Workshops developed by Nature's Ride and delivered by SEDV facilitators and residents to help elementary students gain a clearer understanding of environmentally sustainable practices in their everyday life.

Nature's Ride is a not-for-profit organization focused on delivering workshops related to environmental education and energy efficiency in primary and secondary schools located in the City of Calgary. Through thrilling and fun informative journeys, the main goal of Nature's Ride is to communicate messages of responsibility about the environment, promoting values to respect every human, flora, and fauna present in our planet (Nature's Ride, 2019).

Emphasizing the valuable role that education plays in sustainable development, to ensure a more stable future to the next generations by having social equality, and a prosperous economy while preserving always the environment, this study investigates the positive impact that these workshops have primarily on students, teachers, and SEDV residents and facilitators by achieving a greater awareness level and more pro-environmental behavior, which consequently will benefit the environment. In addition to that, this research evaluates the leadership qualities developed by SEDV residents and facilitators during their participation in the 4E program.

1.3 Energy, Environment and Education

The three pillars of this interdisciplinary study will be energy, environment, and education. Sustainable development is a challenge that is faced by every country around the world. The principal sector with several obstacles but diverse alternatives is the energy industry. Despite the fact that relevant renewable energy sources have been created, significant technologies have been developed, and new strategies to approach sustainability are suggested, the implementation of sustainability in terms of the energy sector still has a lot of goals to achieve.

The enormous impact that non-renewable energy sources, such as exploration and production, have on the environment is known, even more than renewable energy sources. The energy development process has different stages with significant impact on the environment. The same way that production negatively affects the environment, energy consumption by the population also affects the environment negatively.

As the population grows the energy demand increases, intensifying its production, as a consequence, it deteriorates the environment even more. Therefore, it is considered meaningful to transmit to the population the knowledge as to the environmental impact that energy production and consumption possesses. This research is developed by focusing on the relationship between these three aspects.

Sustainable development can be approached from different scopes. Taking into account the above statement, the extensive role that the population plays as energy consumers is one of the perspectives to promote sustainability. This can be accomplished through education. Hungerford and Volk (1990) argued that knowledge has a tight relationship with behavior change. Hence, it is considered that implementing environmental education in elementary schools and expanding students' and teachers' knowledge about energy and environment aspects might achieve greater consciousness about using energy efficiently, alternating energy source to renewable ones, and putting into action other sustainable practices. In this way, a change in their behavior by acting more environmentally friendly might be accomplished. This initiative is expected to contribute

notably to mitigate the negative effect that the energy factor has on the environment.

1.4 Background

The quality of the environment may often be affected by human attitudes and behavior, yet it is not true in all cases. Hence, to better understand, predict, and eventually change behaviors, different psychosocial theories have been identified as possible methods that may help diagnose the selection and sequence of critical cognitive, emotional, and motivational states that precede enacted behaviors (Webb, Sniehotta & Michie, 2010). Through previous research, it was found that numerous studies have been conducted and theories or models have been proposed to predict the awareness, attitudes, and behaviors that support environmental sustainability (ES) or pro-environmental behavior (PEB), (Bajracharya & Maskey, 2016). One of those theories is the Theory of Planned Behavior (Ajzen, 2005-2012), which has been successfully applied in studies examining various types of sustainable environmental behaviors such as travel mode choice (Bamberg, Ajzen & Schmidt , 2003 - De Groot & Steg, 2007), household recycling (Kaiser & Gutscher, 2003 – Nigbur, Lyons & Uzzel, 2010), and general pro-environmental behaviors (Bamberg & Möser, 2007 - Kaiser, Hübner & Bogner, 2005).

However, this is the point where a reasonable question arises. Is there an effect of supplementary education, such as Nature's Ride's workshops which aim to generate a clearer understanding of environmental sustainability, in order to change children's awareness, behavior, attitude, and knowingness toward energy's effect on the environment?

1.5 UNESCO Perspective

The ultimate aim of education is shaping human behavior and create awareness (Hungerford & Volk, 1990), mainly environmental awareness, in this case. To achieve a clearer perception of what environmental awareness means, it is relevant to understand the frailty of our environment, its ecosystem and the importance of its protection (Pachamama Alliance, 2019). It is worth noting that for UNESCO (2014a), *Education for*

Sustainable Development is the inclusion of key sustainable development issues into teaching and learning subjects such as climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. In this way, UNESCO has been leading the United Nations Decade of Education for Sustainable Development (DESD, 2014a) to incorporate the values and principles of sustainable development in every aspect of the education and learning system.

Promoting environmental awareness through participatory teaching and learning methods that motivate and empower learners to change their behavior and take action for sustainable development is an easy way to become an environmental steward and participate in creating a brighter future for our children (Pachamama Alliance, 2019). Education will not achieve a more sustainable future by itself; still, UNESCO's fourth Sustainable Development Goal is aimed to achieve inclusive and quality education for all and, thus, reaffirm the belief that education is one of the most powerful and proven routes for sustainable development. UNESCO (2014b) determines that quality Education for Sustainable Development (ESD) is based on the content taught to people, highlighting its importance for global challenges. Thus, apprentices can develop skills needed that allow them to solve critical environmental, social, and economic challenges to drive prosperity.

It is worth noting to mention that among the findings identified through this research, it can be said that participants of the 4E Program have acquired a higher level of knowledge through the implementation of educative material related to the environment and energy has generated. Consequently, this new knowledge has impacted favorably their attitude toward the environment conservation and executing sustainable practices, as well as it has increased their level of control over performing such activities. Hence, elementary school students, teachers, and SEDV residents and facilitators have obtained a stronger intention to behave more environmentally friendly and contribute to sustainable development.

1.6 EE and ESD in Canada

The *Educating for Sustainability: The Status of Sustainable Development Education in*

Canada Report (Binstock, 2006) provides a precedent study of environmental and sustainable development education initiatives across Canada to obtain outcomes such as students achieving a higher understanding of the differences between positive and negative facts of science's applications in their own lives. Additionally, according to the Ministry of Education report *Acting today, Shaping Tomorrow* (2009) during "an approach of the midpoint of the United Nations Decade of Sustainable Development (2005-2014), governments across Canada and around the world have introduced a wide variety of environmental education and sustainability initiatives" (p. 3).

Therefore, the government of Canada began an examination of the environmental education curriculum to study the needs of students in favor of enhancing the learning on environmental subjects in primary and secondary schools. Strategies and actions were initially developed to promote teaching and learning, student engagement and environmental leadership, as well as measurement frameworks to identify the level in each school. The Ministry of Education report (2009) aimed to explain that "environmental education is not only about visible environmental issues but also about their underlying causes, and so places an emphasis on personal and social values and active stewardship" (p. 25), and it is implemented locally.

Chapter 2: Conceptual Framework

In order to address the issue of sustainable development, the first step is to educate young generations through a system that involves economic growth and environmental integrity to create a fair society for everyone and, thus, encourage them to change their behavior toward sustainability. Nowadays, it is said that children are open to suggestions because they are usually more susceptible to influence. However, Andrius Niaura (2013) researched the determinants of environmental behavior among youth using the Theory of Planned Behavior and found that "behavior is foremost influenced by intentions and that social pressure carried out by relatives or friends had less impact on youth's behavioral intentions in comparison to perceived behavioral control" (p. 75). As they are growing up, social pressure has less potential of generating a significant impact on their behavior.

Nevertheless, it is said by Schultz (2002) that attitudes reflect the people's perspective and respect towards their surroundings and the related environmental issues. To deliver an educative level that allows creating a change in the way that students perceive this issue, it is important to establish relationships among attitudes, behavior, awareness, and knowledge. Therefore, taking into account the main objective of analyzing those psychological aspects, some findings and definitions related to previous studies done in the area are considered.

Throughout the years, behavior has had considerable definitions. Doron and Parot (1999) describe it in their psychology dictionary, as "the interaction of an individual with its environment" (p. 155). Besides, Popescu (2013) considers it "a total response of an organism, in reply to living circumstances, depending on the environmental stimulation" (p. 443). While Ossorio (2006) argues that it is "an attempt of an individual to effect a change from one state of affairs to another or to maintain a currently existing one" (p. 49).

As to environmental behavior, Juraitė (2002) defines it as a behavior that is performed in a conscious way, taking into account social aspects and personal objectives that an

individual would like to achieve by carrying out a particular behavior. Additionally, Krajhanzl (2010) states that people's constant interaction with the environment may define their environmental behavior. Yet, it is normally more related to how human's activities impact the environment, which can be either intentional or not, and it is influenced by external and internal factors that involve the real value of the environment given by an individual and his/her physical and mental state (Krajhanzl, 2010).

Nonetheless, some theories have identified a relationship between attitude and behavior. Because it may be a complex process, it is important to define a specific attitude and behavior to determine their relationship, considering that "general attitudes to predict a specific behavior" may induce a failed result (Wicker, 1969).

2.1 The Theory of Planned Behavior (TPB)

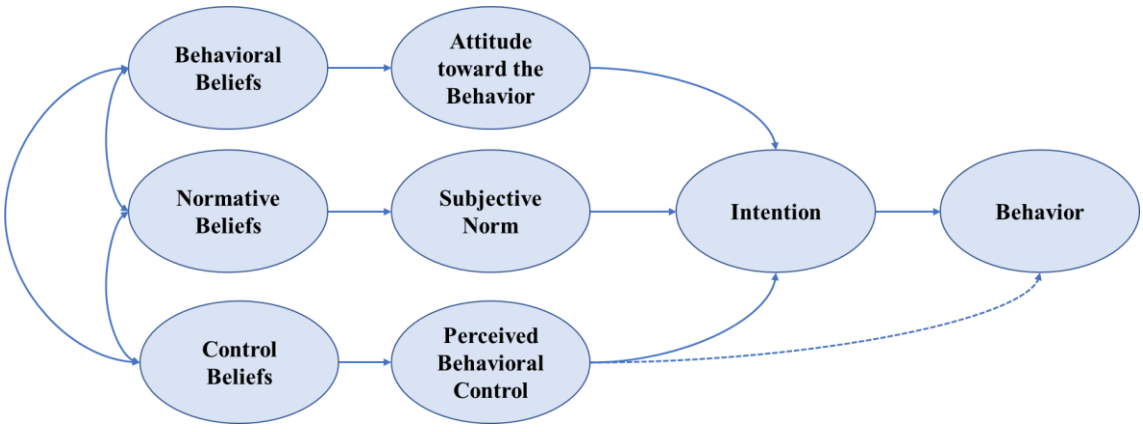
After reviewing numerous studies, Fishbein and Ajzen (1975) deduced that even though attitude should be linked to behavior, it is not always the case and that determining the intention would provide a better prediction of behavior. Subsequently, they developed the theory of reasoned action, which helped to identify a person's behavior through his willful control. However, this theory was not useful in cases under not willful control, which describes a case where persons could not always control their behaviors, but barriers might prevent them from changing behaviors (Fishbein & Ajzen, 1975). According to Hill's (1977) review book, *Belief, attitude, intention, and behavior: An introduction to theory and research*, he contemplates the Fishbein and Ajzen assumption that humans' beliefs, attitudes, behaviors, and intentions are defined by the information and/or knowledge that they have about a specific subject.

Consequently, the Theory of Planned Behavior was developed as an extension of the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Ajzen introduced a new variable in the TPB, known as Perceived Behavioral Control (PBC). One way to disclose a specific human behavior is through both of these theories. A feature of both theories is behavioral intentions which allows for predicting present behavior (Ajzen, 1991).

Following Ajzen (1991), intentions represent the effort that people are willing to apply to carry out a specific behavior and are defined as personal in nature and affected by social influence. The probability of engaging in a certain behavior is as high as the intention to perform it. In addition to that, people's intentions can be different when facing unforeseen events, and can also change over time.

Beyond intentions, the performance of behavior may be affected by other aspects that involve resources needed and opportunity available. To reach a more accurate prediction during the assessment, there must exist compatibility between standards of intention and perceived behavioral control to determine a particular behavior (Ajzen & Fishbein, 1977). Furthermore, it is important to keep stability in intentions and perceived behavioral control during the entire process, especially during evaluation and observation stages. In this way the accuracy of the analysis will not be affected. As volitional control decreases, the prediction will be more focused on perceived behavioral control because it will increase and show real control (Ajzen, 1991).

Figure 1. The Theory of Planned Behavior



Source: Adapted by Author. (Ajzen, 1991)

In order to explain behavioral intention, Ajzen (1991) identified three independent variables which are the attitude toward the behavior based on behavioral beliefs, subjective norms constituted by normative beliefs, and perceived behavioral control formed by control beliefs. These variables influence the intention to perform the behavior,

as Figure 1 shows.

2.1.1 Attitude toward the Behavior

The attitude toward the behavior is in the function of behavioral beliefs people sustain about a specific behavior (Ajzen, 1991). Those beliefs based on the outcomes of the behavior can be evaluated in a positive or negative way, due to features or occasions of those linked to the behavior. If the result is considered favorable, showing significant advantages, the person will hold a positive attitude which may increase the probability of the person participating in that behavior (Ajzen, 2002). Ajzen (1991) argues that the person performs an appraisal about how favorable or unfavorable the regarded behavior is; yet, Ajzen and Fishbein (2005) found that as the condition becomes more favorable, the higher impact attitude has on a person's behavior.

2.1.2 Subjective Norm

Another variable that impacts the intention and consequently behavior is the subjective norm. Formed by normative beliefs, the subjective norm is associated with the social pressure that a person may detect to perform a determined behavior (Ajzen, 1991). It is related to expectations that an individual perceives from his/her relatives, friends, co-workers, or close social group, and according to the importance that the individual gives to this, it may cause an effect in his/her behavior (Ajzen, 2002). For instance, a student may perceive that his parents expect him to always achieve high grades in high school; therefore, the pressure which can either be real or not, due to that perception, could drive the student's efforts to accomplish with parents' expectations.

2.1.3 Perceived Behavioral Control

The third variable with influence on intention and behavior is perceived behavioral control. This is linked to the control beliefs and determines the difficulty of carrying out the behavior (Ajzen, 1991). Ajzen (1991) considers that this feature foresees possible barriers due to previous experiences, involving the attitude of the individual. However,

Ajzen (2002) did demonstrate through another research that the perceived behavioral control is not only integrated by self-efficacy, which defines if the behavior is easy or difficult to perform, but also by controllability, based on how far the individual can control the performance.

According to Cognitive processes mediating behavioral change research, the confidence and ability of a person to perform the behavior influences strongly the behavior (Bandura, Adams, & Beyer, 1977). The stronger the personal motivation is, the less is the possibility of experiencing an unexpected situation (Bandura, Adams, Hardy, & Howells, 1980). Resources and opportunities play a fundamental role in the perceived behavior control of an individual. If a person has more opportunities and resources to perform a behavior, the higher is the control that she/he will have over it (Ajzen, 1991).

2.2 Pro – environmental behavior (PEB)

When it comes to pro-environmental behavior, limited theoretical research has been focused on this topic. However, it has been defined as "behaviors performed by individuals and contribute to environmental sustainability through practices such as using energy efficiently, reducing waste, recycling" (Mesmer-Magnus, Viswesvaran & Wiernik ,2012, p. 160).

As mentioned, TPB explains factors that are related to intentions to perform behaviors as affected by behavioral controls (Ajzen, 2011). Linking that theory with PEB, these behavioral controls or limitations must be considered in an attempt to minimize their effects (Ajaps & McLellan, 2015). This means that learning may not produce the desired behavior, but it can be a useful basis on which norms, values, and beliefs will motivate people to adopt the desired attitude and behavior (Ajaps & McLellan, 2015). Therefore, implementing environmental education may produce a society with more positive attitudes and behavior towards the environment.

Moreover, Ajzen and Fishbein (2005) state that attitudes make the greatest impact on human behavior only when there are favorable conditions. Regarding the analysis found

in the article *Promoting Environmentalism*, Schultz and Zelezny (2000) consider that attitudes of environmental concern are rooted in a person's concept of self and the degree to which an individual perceives him or herself to be an integral part of the natural environment.

Some findings which have used the TPB as a measurement instrument are Andrius Niaura's (2013) and Astrid de Leeuw & Pierre Valois's (2014) research. De Leeuw et al. (2014) developed a study about the beliefs of primary school students in Luxemburg in regard to pro-environmental behavior (PEB). The results obtained showed that "educational interventions should focus on promoting students' feelings of control over pro-environmental behaviors" (De Leeuw et al. 2014, p.1427). In addition to that, it was found that "developing positive attitudes in students by stressing the various benefits of PEB for keeping our planet clean and protecting wildlife" is important to change behavior (De Leeuw et al. 2014, p.1427).

As to Andrius Niaura's (2013) study, he implemented the TPB through online surveys. The study aimed to determine the gap between environmental attitudes and the current behavior of young people. Niaura (2013) revealed in the analysis that those "who expressed their relatively stronger environmental intentions and behaved respectively were twice as many as those whose intentions were less environmentally friendly" (p. 79). Also "social pressure generated an inferior impact on youth's behavioral intentions in comparison to perceived behavioral control" (p. 80).

2.3 Competing Values Framework

Living in a changing world, it is fundamental for organizations to identify strategies that lead them to achieve success. The effectiveness of management is a factor that helps to determine the prosperity of a company, jointly with leadership abilities in its culture. According to the competing values framework developed by Quinn and Cameron (2010), these four aspects must be evaluated to define which predominate the corporation.

The competing values framework is originally based on four theoretical models related to

management applications representing opposite or competing suppositions (Quinn & Cameron, 2010). The four core values are to collaborate, control, compete, and create. However, for this research, the competing values framework has been adapted accordingly to determine competencies necessary for leadership in the area of sustainability and sustainability education.

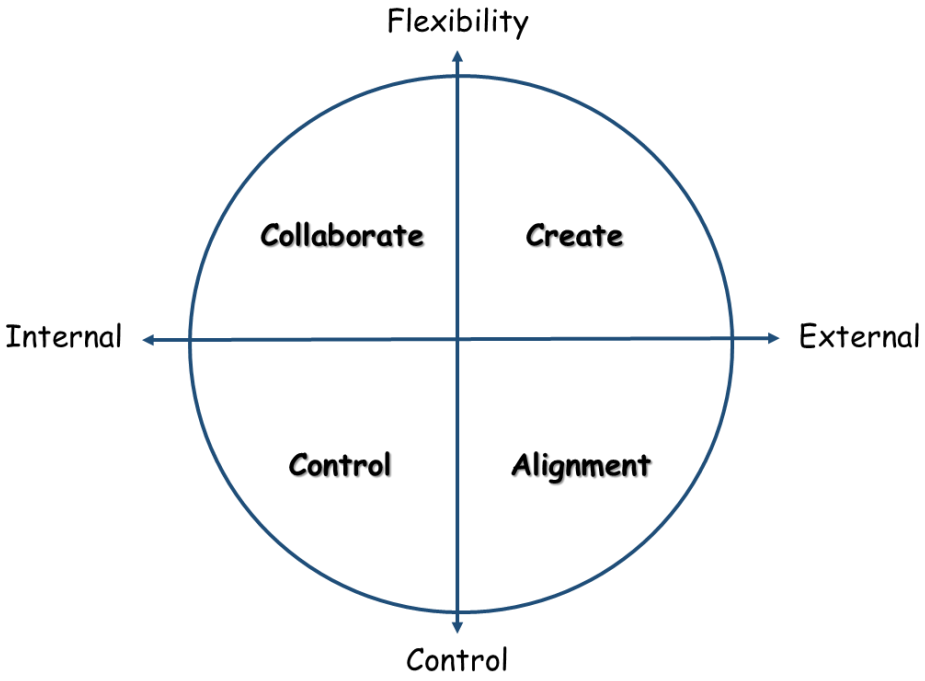
Using the Competing Values Framework (Quinn, Bright, Thompson & McGrath, 2015) as a foundation, the Competencies Framework for International Internships was created by a research team at the Haskayne School of Business, University of Calgary. Four broad categories were defined: Alignment, Control, Collaborate, and Create. Each broad category contained five sub-categories with various examples under each of the sub-categories (Dugan, George & Herremans, 2016). The researchers created the framework to investigate the potential for developing leadership qualities among SEDV students through their participation in international internships that provided environmental education to high school students in Ecuador. The content in the international internships was similar to that of the 4E (Environmental Education Energy Efficiency) program (the focus of the current research), but SEDV students from the program in Calgary, Alberta spent four weeks in Ecuador at various locations, working with high school students in environmental education workshops, seminars, and experiential learning activities. Each SEDV student in the international internships journalized their activities for the four weeks of the internship and reflected on the transformations that took place in their leadership abilities over that time. Upon returning from the Ecuador experience, the research team content analyzed the SEDV students' journals to determine what leadership qualities they developed and subsequently created the Competencies Framework for International Internships. The Competencies Framework was adjusted to fit the 4E Program for the data collection process. Survey questions were developed from each of the four broad categories and their sub-categories.

Focused on the human relations model, the **collaborative** value was created to replace the compete value in the original framework. As the name implies, collaboration is related to the implementation of techniques that involves human resources such as teamwork, employee empowerment, creating commitment, and encouraging open and respectful

communication with each other (Quinn & Cameron, 2010).

Alignment is based on the leadership qualities necessary to prepare for an activity. It is similar to the planning stage, covering the creation of commitment in self and others, development of a mission according to stakeholders' needs, and achieving agreement to reach objectives.

Figure 2: Competency Values Framework



Source: Adapted by Author. (Quinn & Cameron, 2010)

Create is linked to the open systems model. Creativity and fostering innovation are part of this value as factors to be considered when adaptation is required, taking into account the changing environment and recognizing a significant tendency (Quinn & Cameron, 2010).

Control is the last core value of the framework, based on the internal process model. As rules are established to achieve goals, assessing and maintaining the accomplishment of those rules continually is reflected in the control value.

Chapter 3: Methodology

Considering the literature reviewed to conduct this research, the methodology implemented is to determine the change in children's awareness and behavior toward environmentally sustainable practices. The research was based on data collection obtained through diverse questionnaires applied to students and teachers from schools that received Nature's Ride's programs, as well as its SEDV residents and facilitators who delivered the workshops and programming.

Initially, to define the methodology structure the three educational programs developed by Nature's Ride were taken into account. The educational programs are integrated into the Environment and Energy Efficiency Education Program (4E Program). The 4E Program's objective is to create awareness and develop skills of students and teachers with the purpose of building their capacity to take action on energy efficiency and renewable energy (Nature's Ride, 2019). The two main programs are Environment and Energy Residency Program (E2RP) and Junior Energy Specialist Training (JEST).

The E2RP presents the latest research in areas such as energy efficiency, behavioral change, and closed loop systems, with different teaching options, where topics were chosen and prepared with teachers to reach higher student participation. The JEST is divided into two programs. The first is Junior Energy Inspector (JEI) which is focused on encouraging students to become a home energy inspector and creating consciousness about energy consumption to reduce its environmental impact. The second is Junior Energy Prosumer (JEP) that describes the process of how to generate energy through a biodigester using organic waste. Also, students are taught the closed-loop system and its importance.

In pursuance of elaborating a well-structured and easily accessible questionnaire for participants, Qualtrics was used, a specially designed tool for research data collection performed through surveys. A Likert scale system was implemented to obtain accurate results in each one of the questionnaires as Table 1 shows. Additionally, the participants responses were kept anonymous, as anonymity was considered a stimulus for

participation, a way to preserve participants' identity, and therefore to achieve authentic and reliable responses.

Table 1 - Scale system for evaluating questionnaires results

Scale	Range
Not at all	0 - 1.4
Slightly	1.5 - 2.4
Moderately	2.5 - 3.4
Considerably	3.5 - 4.4
Extensively	4.5 - 5

Source: Author, 2020

The variables used to determine the behavior in participants were mainly the attitude and perceived behavioral control. Based on the previous researches, these two variables are the most impactful in the intention that carries out behavior change (Niaura, 2013). Besides, the short period for which the research was conducted did not provide the scenario to determine the subjective norm variable, as the learning phase was not beyond the classroom interaction.

Questionnaires were distributed across 12 educational institutions (8 elementary schools, 3 junior high schools and 1 high school), involving 48 teachers, 5 E2RP residents, 4 JEST facilitators and 316 students. It is important to mention that the distribution of residents' and teachers' questionnaires was carried out through email. As to students, the distribution was performed through polls during online workshops delivered through Zoom. It is worth noting that questionnaires for teachers and residents/facilitators were applied at the end of the residences and/or workshops. The data collection was delayed due to the ethical approval necessary to the conduct research and was not obtained until after the delivery of the program started.

3.1 Leadership Qualities Questionnaire for Residents and Facilitators

To identify the effectiveness of the 4E program a questionnaire was designed based on the competing value framework for residents and facilitators to determine the leadership and managerial skills. Knowing that the framework is formed by four competencies mentioned previously in the literature section, it is worth noting that the framework was adapted to meet the needs of the educative program. The Competencies Framework was adjusted to fit the 4E Program for the data collection process. Survey questions were developed from each of the four broad categories and their sub-categories.

3.1.1 Alignment

The first section of the questionnaire was Alignment focused on the planning stage, involving preparation carried out by residents and facilitators to take action for any presented opportunity. The sub-parts evaluated in this competency are the following:

a) Developing a vision/mission that potentially meets stakeholders' needs.
b) Developing agreement and commitment.
c) Preparing for achieving objectives.
d) Creating commitment to self and others.
e) Developing and organizing for action.

3.1.2 Control

Continually, the second section was about Control based on plans and procedures development performed by residents and facilitators including a phase of following up to ensure the expected outcomes are achieved. On this section, participants' control quality was assessed through the following sub-parts:

a) Checking for alignment in the host school.
b) Preparing to manage across functions.
c) Planning and coordinating efforts.

d) Encouraging and enabling interest.
e) Measuring and monitoring performance and quality.

3.1.3 Create

Create is the third division of the questionnaire and is designed to evaluate leadership skills during the 4E program development. The items help to determine the resource and imagination put into practice by participants that allowed them to achieve the expected outcomes. Sub-parts of this quality are:

a) Using power and influence ethically and effectively.
b) Championing and selling new ideas.
c) Fuelling and fostering innovation.
d) Revisiting alignment to determine if change meets stakeholder needs.
e) Implementing and sustaining change to new ideas.

3.1.4 Collaborate

Finally, to evaluate the self-management and contribution to others' work targeting the achievement of proposed goals, a fourth dimension was elaborated known as Collaborate. This involves the following criteria:

a) Understanding the self and others.
b) Communicating honestly and effectively.
c) Guiding others in their development.
d) Managing groups and leading teams.
e) Managing and encouraging constructive conflict.

In addition to questions established for each section, an additional box was provided in each of those categories that allowed participants to provide more details about their answers for the research to achieve a higher understanding.

3.2 Questionnaire about Behavior and Program Quality for Residents and Facilitators

To investigate the change of behavior on residents and facilitators that delivered the 4E program, queries were created related to their attitude and perceived behavior control, as well as their perspective about the program quality. Evaluating the connection that residents and facilitators would develop with students through educative programs, it was considered significant to add questions that alternatively allow for determining students' behavior and attitude change perceived by facilitators and residents. A consent form is initially found to guarantee reliability of the data collection process. Each section of the questionnaire is discussed now.

3.2.1 Introduction

This section is focused on determining the type of program delivered by the respondent, training section(s) they attended provided by Nature's Ride and its partners, and the elementary school grades to which they delivered the workshops. The responses are multiple-choice style as some residents delivered several different workshops and covered different grades. A sample of the questions asked in each section is found in the next paragraphs.

3.2.2 My Learning as a Facilitator/Resident: Awareness, Learning, and Behavior

Noting that Nature's Ride offered training sections to all residents and facilitators, provided by itself, and also through partnerships with other non-profit organizations involved in the environmental education field such as Teach PEEL, Dream Rider, and CAWST, the research considered how useful those training sessions were for respondents for developing and delivering workshops in schools. It is important to mention that in this and the next section of the questionnaire the Likert-scale was used.

Moreover, this section sought to assess the level of involvement undergone by facilitators

and residents during the workshop delivery and whether their expectations about the whole program were met. In this way, aspects such as the growth of awareness toward sustainability as well as knowledge improvement, and a better attitude toward environmental impacts, would be determined as consequent effects of their participation as lecturers of the 4E program. Among those queries are:

a. I enjoyed my experience(s) in the classroom as a facilitator/resident in Nature's Ride's 4E program. (Quality)
b. Overall, Nature's Ride's program met my expectations. (Quality)
c. I have a greater awareness of my personal role in making energy more sustainable. (Attitude)
d. I noticed a change in my attitude toward living a life with fewer environmental impacts. (Attitude)
e. Being part of Nature's Ride's Programs, my sustainable development knowledge improved. (Attitude)

3.2.3 Elementary School Students' learning: Overall Quality and Improvements to the Program

A very important feature of this research is to define the program quality in all aspects, taking into account that it was the first educative program on energy efficiency launched by Nature's Ride.

Similar to the previous section, similar questions were selected focusing on elementary school students that attended workshop sections to estimate the level of awareness generated in them through engagement and knowledge gained during workshops considering the complexity of topics taught. Questions based on attitude and perceived behavioral control integrate the elementary school students' learning category, as are shown next:

a. Students' level of knowledge about sustainable practices increased. (Knowledge)
b. Students' level of knowledge about different types of energy improved.

(Knowledge)

c. The level of complexity about topics delivered fits well with the students' grade level. (Quality)
d. After receiving the program, students understand how they can make a sustainable difference. (Perceived Behavioral Control)
e. Students' have a better understanding of how energy affects their lives. (Knowledge)
f. Students comprehend that there are sufficient natural resources if we learn how to use them sustainably. (Perceived Behavioral Control)
g. Students appeared engaged during the delivery of workshops. (Attitude)
h. Students have a greater awareness of their roles in making energy more sustainable. (Attitude)

Furthermore, additional questions were part of the elementary school students' learning section centered on the program quality. This offered the opportunity for respondents to share their opinion about areas that may be enhanced to escalate the impact that the 4E program might have on students and, thus, expand their pro-environmental behavior. Suggestions for improving facilitators and residents' experience before, during, and after workshops were requested of participants. They were also asked about possible techniques that can be applied to engage and make a greater impression on students about the subject, as well as relevant topics that should be part of the educative program to create more consciousness by extending their knowledge about sustainable development.

3.3 Questionnaire about Behavior and Program Quality for Teachers

Taking into account teachers' participation in the 4E program since the initial stage, in which leading teachers (champions of the environment) got in touch with Nature's Ride to be part of the educative program offered, it was assumed that there would be an effect on their behavior and attitude toward sustainable development. Therefore, a questionnaire was designed to measure variables such as attitude and perceived behavioral control on them after finishing the residence or workshop program. Likewise,

teachers' perspectives were collected to evaluate students' behavior change and knowledge level, as they have had a longer scholarly relationship with the students and have a better understanding of students' comprehension.

3.3.1 Introduction

This straightforward section contained the consent form and queries about the 4E program received, including the grade of their class and the number of students attending the session. Multiple-choice answers were set up in this section as teachers may oversee more than a group.

3.3.2 Awareness, Learning and Behavior

Facilitators delivered specific topics, however, residents selected topics to be taught according to what teachers requested, all of them related to energy efficiency, environment preservation, practices to reduce human environmental impact, among others. The awareness, learning, and behavior section was aimed to assess teachers' understanding of subjects taught and activities involved in workshops. As it is shown below, some of the inquiries were focused on demonstrating how useful residences or workshops were to enhance their knowledge about different sustainable practices that can be performed by citizens daily, and if they created more consciousness on them impacting their pro-environmental behavior positively.

a. Nature's Ride's Programs improved my understanding of energy-related topics. (Attitude)
b. Nature's Ride's Programs improved my students' understanding of energy topics. (Attitude)
c. I have a greater awareness of my personal role in making energy more sustainable. (Attitude)
d. My students have a greater awareness of their roles in making energy more sustainable. (Attitude)
e. I know how I can make a sustainable difference. (Perceived Behavioral Control)

f. My students know how they can make a sustainable difference. (Perceived Behavioral Control)
g. I comprehended that the Earth has plenty of natural resources if we just learn how to use them sustainably. (Perceived Behavioral Control)
h. My students comprehended that the Earth has plenty of natural resources if we just learn how to use them sustainably. (Perceived Behavioral Control)
i. I noticed a change in my attitude toward living a life with fewer environmental impacts. (Attitude)
j. I noticed a change in the attitude of the students towards living a life with fewer environmental impacts. (Attitude)
k. My students appear engaged during the delivery of workshops. (Attitude)

In addition to that, teachers were asked about their point of view as to students' attitudes and awareness toward the environment and sustainable practices after receiving workshops. The Likert scale cited initially has been applied in this section of the questionnaire, as well as in the next.

3.3.3 Overall Quality and Improvements to the Program

The program satisfaction assessment was incorporated in this section, with queries that allow obtaining valuable overviews and suggestions from teachers. The main goal of this part of the survey is to achieve an outcome that defines the program structure needed to boost the learning in elementary school students through different methods that grant a higher level of awareness generating a change of behavior toward sustainability. Easy understanding questions, shown below, were designed to provide a result about the usefulness of the 4E program for teachers and schools.

a. Nature's Ride's workshops helped in my daily teaching of the environmental subject matter. (Quality)
b. The level of complexity about topics delivered was adequate for students' grade level. (Quality)
c. The delivery methods, including the time for each session, were effective.

(Quality)

d. The program met my expectations. (Quality)
e. Considering your complete experience with Nature's Ride's Program, I am likely to recommend this to a colleague or another institute. (Quality)
f. Overall, the school benefited from the quality of the programs. (Quality)

Alternatively, participants could find two more optional questions where they could express an extended opinion about the educative program, including their suggestions.

3.4 Elementary School Students' Awareness Level Questionnaire

Having as the main objective of evaluating children's behavior change through educative methods to enhance their pro-environmental behavior, the questionnaire developed for elementary school students was mainly focused on measuring the change in their knowledge level about the content of the workshops. The principal reason for this methodological phase being somewhat different is due to the necessity to move the face-to-face workshops to online sections because of the COVID-19 pandemic. Additionally, ethical concerns about collecting research data from elementary school children were faced during the study.

In consideration of the above, and the new strategies implemented by Nature's Ride to continue delivering the 4E program virtually, four straightforward surveys were designed for attendant students. The topics covered during the sessions of the online workshop were Climate Change, Fossil Fuel, Microbial Fuel Cell, and Waste. During online program delivery, the same survey was staged at the beginning and the end of the session, to perform a comparative analysis of students' knowledge about the topic taught and how it was improved through the workshop. Furthermore, questions related to human activities that impact on the environment were taken into consideration. Following are examples of some questions:

a. How much do you know about using natural resources so there is plenty for everyone?

b. How much do you know about the damage to nature (air, water, and land) caused by human activities?
c. How much do you know about things that humans can do to stop the damage from climate change?
d. How much do you know about organic and inorganic waste?
e. How much do you know about the damage to animals caused by human waste?

Other questions applied in these assessments are available in appendix A. The Likert-scale used for students' questionnaires is similar to that implemented in the residents and facilitator questionnaire, yet with easy understanding ranges as shown in Table 2.

Table 2 - Likert-Scale for Students' Questionnaires

Scale	Range
Nothing	0 - 1.4
A little bit	1.5 - 2.4
Some	2.5 - 3.4
Quite a bit	3.5 - 4.4
A lot	4.5 - 5

Source: Author, 2020

A particular query was added to the waste workshop, based on activities that students considered to be performed in order to lessen the damage to nature generated by waste. Response choice was select one or more of activities that lessens the damage to nature:

- Not use paper plates or plastic cutlery
- Recycle as much as you can
- Bring your own bags to the grocery
- Donate clothes, toys, and books

The goal of the mentioned question aimed to determine their intention of protecting the environment from common human activities.

Chapter 4: Analysis and Discussion of Finding

Based on the Theory of Planned Behavior, the data collection structure was designed and implemented in elementary school students and teachers, as well as in SEDV residents and facilitators to evaluate the effect that environmental education had on modifying their behavior after their participation in the 4E program. Likewise, the competency values framework was used as a model to determine leadership abilities developed by SEDV residents and facilitators by their involvement in the different stages of Nature's Ride education programs.

Below, Table 3 displays the Likert-scale applied to questionnaires responded to by teachers and SEDV residents and facilitators, such as the behavior and program quality surveys as well as the leadership qualities questionnaire. A similar scale was implemented in elementary school students' awareness questionnaire, shown in table 2 from the previous chapter. It is important to say that the small size of samples collected from SEDV residents and facilitators questionnaires is related to the magnitude of the program. However, the number of participants from elementary schools, such as teachers and students, was relevantly higher. In the same way, the number of responses obtained from each questionnaire applied is related to the size sample.

Table 3 - Scale system for evaluating questionnaires results

Scale	Range
Not at all	0 - 1.4
Slightly	1.5 - 2.4
Moderately	2.5 - 3.4
Considerably	3.5 - 4.4
Extensively	4.5 - 5

Source: Author, 2020

Another relevant aspect is the variables assessed in the behavior questionnaires. Based on the time available to carry out this research and the appropriate methodology to

analyze each variable suggested by the Theory of Planned Behavior, the subjective norm was not considered in this study. This is because to assess the subjective norm an extensive period is required as it is based on the effect that social impact has on behavior change, for instance, the importance that an individual gives to his family's, friends', coworkers' opinion about performing a particular behavior (Ajzen, 1990). In the next sections of this chapter, a detailed analysis is provided according to the data collected from the previously mentioned questionnaires.

4.1 Residents and Facilitators' Leadership Qualities Analysis

Knowing that organization's effectiveness leads to its success (Quinn & Cameron, 2010), the SEDV residents' and facilitators' leadership qualities questionnaire results have been analyzed to determine the level of leadership development during their participation in the 4E program. From 11 SEDV residents and facilitators that participated in the program, 6 was the number of responses obtained for this questionnaire, as Figure 3 shows. The overall mean factor among the four features that are integrated in the Competencies Framework is 4.4 out of a possible 5 (with 5 representing extensively as Table 3 shows above).

The four competency values have been analyzed in detail to identify the most relevant aspects experienced and techniques developed by residents and facilitators in the 4E program. Figure 4 displays a considerable level of control, creativity, collaboration, and alignment skills evolved by residents and facilitators. The general mean factor also indicates the significance of the role played by residents and facilitators in different stages of the 4E program development to achieve remarkable outcomes.

Figure 3 - SEDV residents' and facilitators' participation in leadership qualities questionnaire.

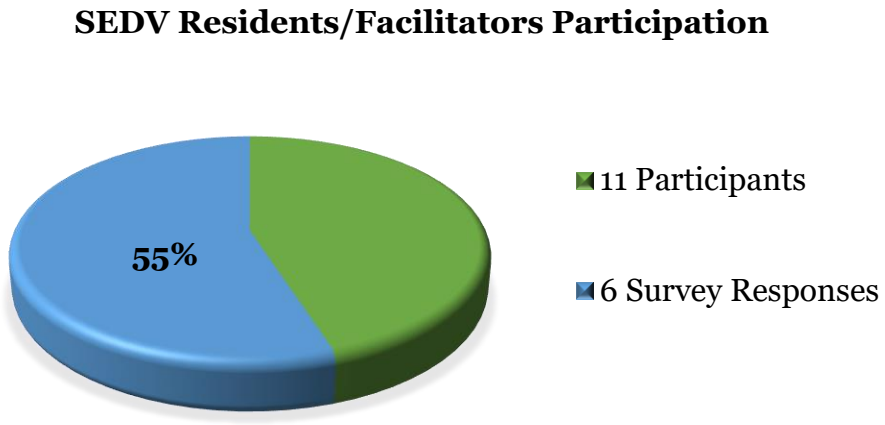
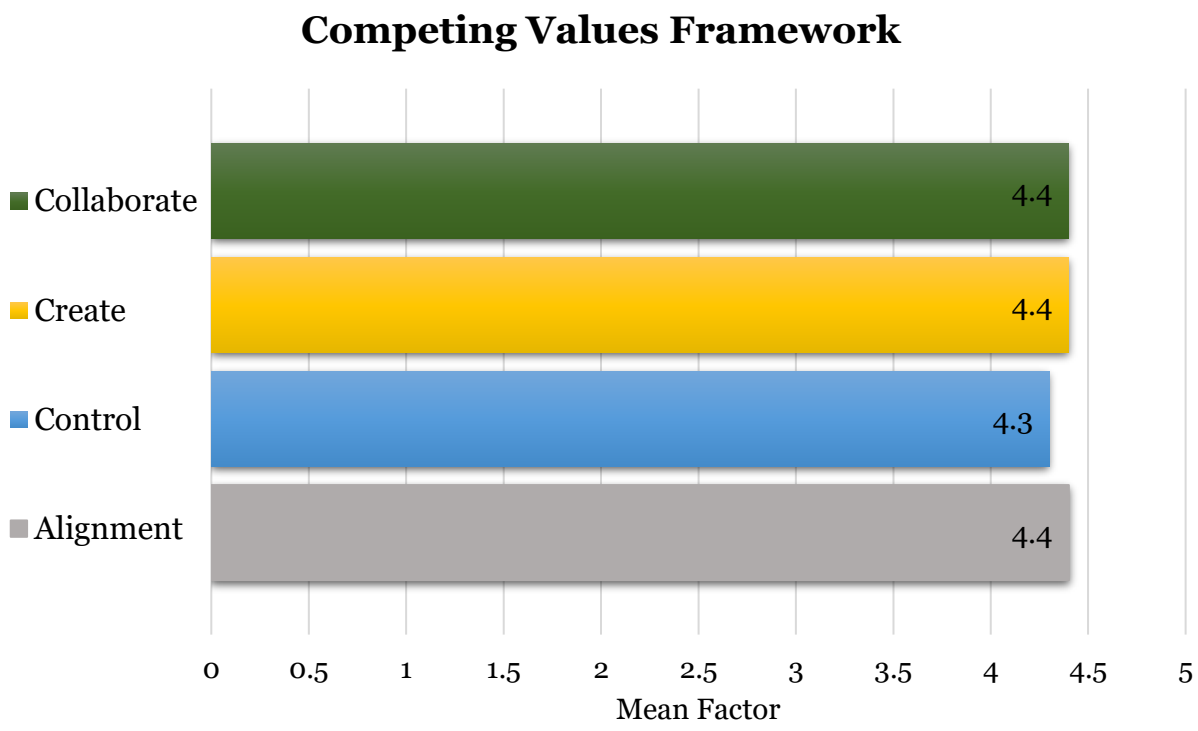


Figure 4 - The mean factor of each competency value evaluated in the leadership qualities questionnaire.



Initially, having known that alignment skill mainly centers on the mission of the organization (Dugan, George & Herremans, 2016), residents and facilitators demonstrated a wide understanding of it, and of the necessary steps to be carried out to achieve the program's mission. According to Table 4 and participants' responses, establishing objectives, and preparing the method to accomplish these were crucial for the program's success. Additionally, by examining school requirements, participants revealed extensive agreement and commitment with stakeholders to meet their expectations. Based on a 4.4 mean factor, the alignment skill was considerably expanded by SEDV residents and facilitators.

Table 4 – Competency Values Based on Alignment Category developed by SEDV residents and facilitators in the 4E program

Alignment	Mean	Scale
Developing a vision/mission that potentially meets stakeholders' needs	4.2	Considerably
Developing agreement and commitment	4.8	Extensively
Preparing for achieving objectives	4.5	Extensively
Creating commitment in self and others	4.3	Considerably
Developing and organizing for action	4.3	Considerably
	4.4	**Considerably**

Another skill evaluated was control, which is based on setting up and sustaining continuity as well as balance on meeting goals established (Quinn et al, 2010). In this section, residents and facilitators showed a considerable level of managing and following necessary plans to achieve objectives by reaching a mean factor of 4.3 as Figure 4 shows. According to the Table 5, participants considered having put in considerable effort during the workshops' planning and coordination stages and constantly encouraged receptors such as teachers and principals to be part of this process by sharing their needs according to scholarly curriculum and their expectations of the educative program. However, participants perceived lower control in monitoring performance quality. Despite the fact that some of them constantly coordinated and verified with stakeholders that procedures

were followed, there was not a relevant performance measurement application from them in classrooms.

Table 5 - Competency Values Based on Control Category developed by SEDV residents and facilitators in the 4E program

Control	Mean	Scale
Checking for alignment in the host school	3.8	Considerably
Preparing to manage across functions	4.5	Extensively
Planning and coordinating efforts	4.7	Extensively
Encouraging and enabling interest	4.8	Extensively
Measuring and monitoring performance and quality	3.8	Considerably
	4.3	**Considerably**

On the other hand, recognizing and adapting to the changing environment is carried out by creativity which is one of the competing values (Quinn & Cameron, 2010). Analyzing SEDV residents' and facilitators' survey responses about creativity which obtained a mean factor of 4.4 (Figure 4), it can be stated that adaptation has been a key factor to meet stakeholders' interest by linking it with resources offered by Nature's Ride. Based on Table 6, participants did outstanding in their skills in championing and fostering new concepts about the implementation and content of educative material. Also, participants indicated that critical thinking is fundamental in educative programs considering the learning level of children who are usually eager to learn about new topics. Implementing imagination and creativity in each session delivered could add value to the students' experience and learning process. This skill has been developed considerably by SEDV residents and facilitators by promoting diverse and practical teaching in order to gain higher engagement from students and expand their learning ability. Effective communication was held by residents and facilitators with teachers to ensure that objectives established were achieved.

Table 6 - Competency Values Based on Create Category developed by SEDV residents and facilitators in the 4E program

Create	Mean	Scale
Using power and influence ethically and effectively	4.2	Considerably
Championing and selling new ideas	4.7	Extensively
Fueling and fostering innovation.	4.5	Extensively
Revisiting alignment to determine if change meets stakeholder needs	3.8	Considerably
Implementing and sustaining change to new ideas	4.7	Extensively
	4.4	**Considerably**

Table 7 - Competency Values Based on Collaborate Category developed by SEDV residents and facilitators in the 4E program

Collaborate	Mean	Scale
Understanding self and others	4.2	Considerably
Communicating honestly and effectively	4.3	Considerably
Guiding others in their development	4.5	Extensively
Managing groups and leading teams	4.6	Extensively
Managing and encouraging constructive conflict	4.3	Considerably
	4.4	**Considerably**

Furthermore, SEDV residents and facilitators did create and sustain a commitment to each other through collaboration. As the fourth competing value, collaboration involves respectful communication as well (Quinn & Cameron, 2010). In this result, participants highlighted how essential empowerment was for them to contribute to supporting each other and sharing their experiences by enforcing best practices. The collaboration value is represented by a 4.4 mean factor (Table 7), indicating steady teamwork that has led to the 4E program success. Honest and open communication that allowed ideas exchange to enhance the program quality was part of those abilities implemented by SEDV residents

and facilitators. In addition to that, collaboration was one of the principal factors to be applied since the first encounter with school representatives.

4.2 Analysis of Residents and Facilitators Behavior and Program Quality

It is known that the 4E program has been delivered by residents and facilitators who graduated or are enrolled in the SEDV program. Considering their expertise obtained through the master's program, it was believed that it would boost children's learning about environmentally sustainable practices. Among 11 SEDV residents and facilitators that participated in the educative program of Nature's Ride, 6 were involved in the Environment and Energy Residency Program, 3 delivered the Junior Energy Inspector program, and 2 the Junior Energy Prosumer program. Displayed in the Figure 5, questionnaire responses obtained from those 11 SEDV residents and 9 facilitators. Table 8 shows the number of survey responses based on each educative program delivered.

The behavior and program quality questionnaire completed by SEDV residents and facilitators was designed with questions based on attitudes and perceived behavioral control variables that allow for determining if intention is likely to lead to actually performing a behavior (TPB). Those variables were evaluated through queries to SEDV residents and facilitators about the perception of themselves after delivering workshops and their opinion about elementary school students after receiving the 4E program. It is important to mention that the subjective norm variable was not considered in this evaluation due to the short time for which the study was carried out and the difficulty of obtaining valid results that determine the impact on the participants' behavior.

Figure 5 - SEDV Residents' and Facilitators' Participation in the Behavior and Program Quality Questionnaire

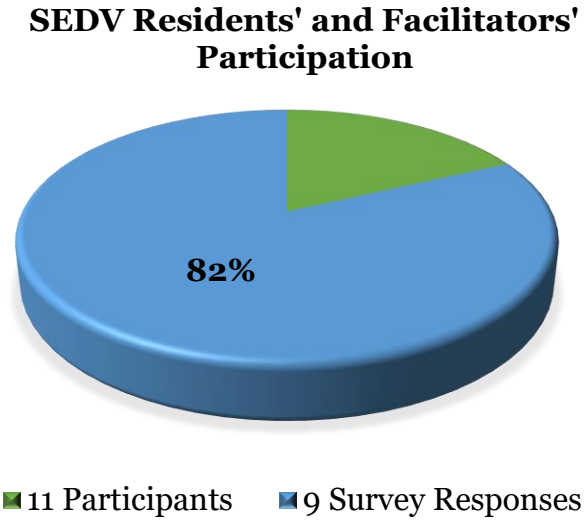


Table 8 - Number of questionnaire responses based on each educative program delivered in the 4E program

4E Program	Survey Responses
E2RP	5
JEP	2
JEI	2

According to mean factors demonstrated in Table 9, SEDV residents and facilitators perceived a considerable level of favorable attitude toward environmental practices. By delivering educative programs about the environment and the impact that energy generation has on it, SEDV residents and facilitators gained a higher level of awareness about it, making them act in a more sustainable way. Equally, this knowledge acquired has led them to change some of their daily life habits to contribute to environmental impact reduction. Generally, SEDV residents and facilitators believed that their participation in the 4E program has expanded considerably their sustainable development knowledge.

Table 9 - The Mean Factor of SEDV Residents and Facilitators Attitude Perceived by Themselves after Delivering Workshops

SEDV Residents and Facilitators Attitude (n = 9)	Mean	Scale
I have a greater awareness of my personal role in making energy more sustainable.	4.3	Considerably
I noticed a change in my attitude toward living a life with fewer environmental impacts.	4.2	Considerably
Being part of Nature's Ride's Programs, my sustainable development knowledge improved.	4.3	Considerably
	4.3	**Considerably**

In addition to that, SEDV residents and facilitators believe that elementary school students gained a higher level of knowledge about different energy sources, as well as practices that can be carried through to make energy use more sustainable. Results displayed in Table 10 indicate that SEDV residents and facilitators observed a significant level of engagement from students during workshops by sharing their thoughts, asking questions related to the topic delivered, and exchanging some ideas, showing a notable interest in the environment and energy, generating a positive attitude on students.

Therefore, students learned that performing simple activities such as using energy and water more efficiently by turning off devices when not using them or the tap when brushing teeth, composting, recycling, and planting trees, may contribute generously to mitigate the environmental impact caused when not doing those activities. This new level of knowledge acquired by students helps them to have a more affirmative attitude.

Likewise, SEDV residents and facilitators considered that students have higher comprehension about natural resources found in the Earth, understanding there is enough for every inhabitant of the planet, yet their use must be done sustainably. Knowing this, students realized that they can make a difference to preserve the environment by implementing sustainable practices that will benefit them and the coming generations (Table 11).

Table 10 - SEDV Residents and Facilitators Opinion about Elementary School Students' Attitude after Receiving Workshops

SEDV Residents Opinion about Students' Attitude (n = 9)	Mean	Scale
Students appeared engaged during the delivery of workshops.	4.0	Considerably
Students have a greater awareness of their roles in making energy more sustainable.	4.1	Considerably
	4.1	**Considerably**

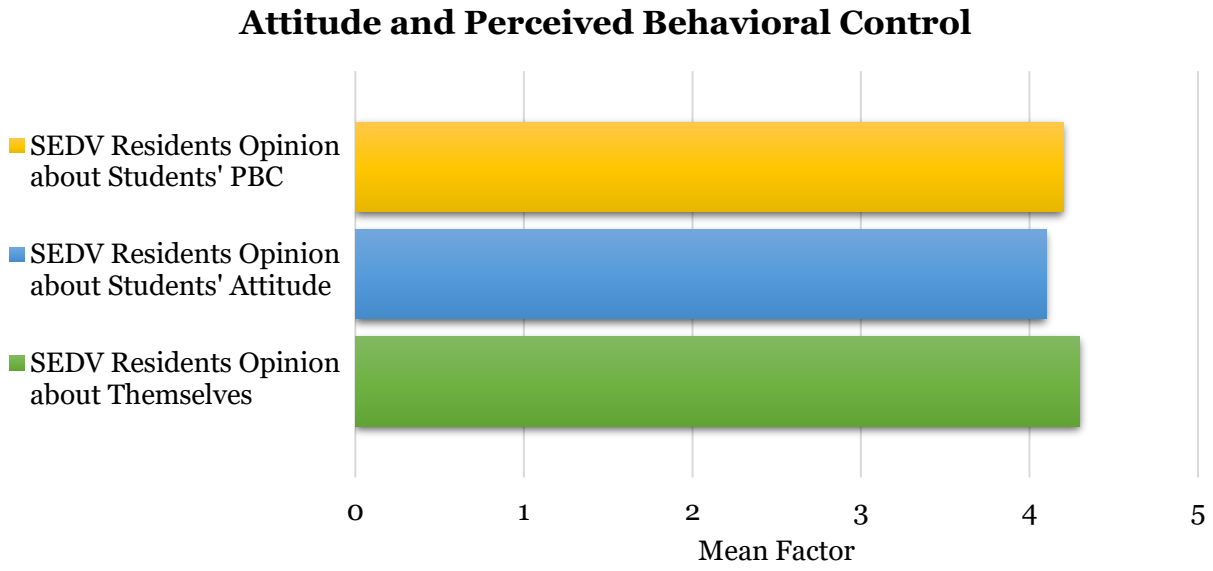
Table 11 - SEDV Residents and Facilitators Opinion about Elementary School Students' Perceived Behavioral Control after Receiving Workshops

SEDV Residents Opinion about Students' PBC (n = 9)	Mean	Scale
After receiving the program, students understand how they can make a sustainable difference.	4.0	Considerably
Students comprehend that there are sufficient natural resources if we learn how to use them sustainably.	4.4	Considerably
	4.2	**Considerably**

Figure 6 represents mean factors for attitude and perceived behavioral control from SEDV residents and facilitators. As observed, elementary school students' attitudes identified by SEDV residents and facilitators is 4.0 while SEDV residents and facilitators attitude of themselves is 4.4. This slight difference means that SEDV residents and facilitators perceived a considerable attitude in students reflected in the attitude that they perceived on themselves.

Citing Ajzen (1991), a favorable attitude toward behavior and a significant perceived behavioral control lead to a stronger intention to perform that behavior. And, by nourishing that knowledge, it might be more probable to generate a better attitude and change behavior (Hungerford & Volk, 1990).

Figure 6 - Mean factor of the attitude and perceived behavioral control of SEDV Residents and Facilitators, and their opinion about students'



Taking into account that SEDV residents and facilitators' opinions that students have learned more about diverse sustainable practices, as Table 12 reflects, the level of difficulty for applying those and the advantageous result that it may cause, it can be assumed that students might have a better attitude and higher perceived behavioral control by feeling confident in performing those activities and behaving more environmentally friendly.

Consequently, the program quality has been assessed through SEDV residents and facilitators questionnaire. According to Table 13, participants have categorized the 4E program considerably good, expressing how valuable and enjoyable their experiences in the classrooms were, and the importance of sharing meaningful knowledge with students. Additionally, SEDV residents and facilitators considered that topics delivered to elementary school students held a reasonable level of complexity which was satisfactorily handled by them. In this way, participants' expectations about the 4E program have been widely met.

Table 12 - SEDV Residents and Facilitators Opinion about Elementary School Students Knowledge after Receiving Workshops

SEDV Residents Opinion about Students' Knowledge (n = 9)	Mean	Scale
Students' level of knowledge about sustainable practices increased.	4.5	Extensively
Students' level of knowledge about different types of energy improved.	4.3	Considerably
Students have a better understanding of how energy affects their lives.	4.4	Considerably
	4.4	**Considerably**

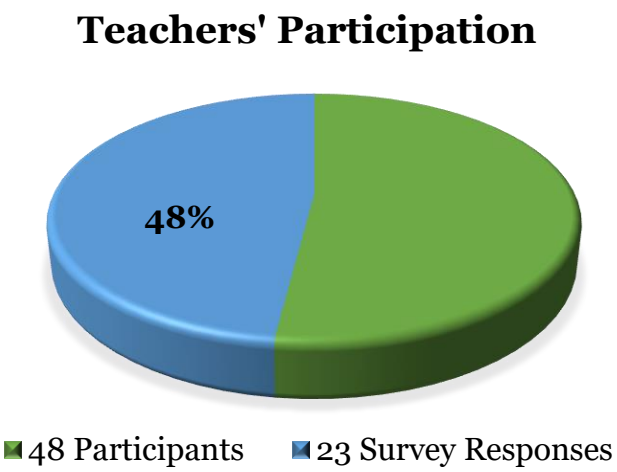
Table 13 - SEDV Residents and Facilitators Perspective about Program Quality

Program Quality (n = 9)	Mean	Scale
I enjoyed my experience(s) in the classroom as a facilitator/resident in Nature's Ride's 4E program.	4.7	Extensively
Overall, Nature's Ride's program met my expectations.	4.3	Considerably
The level of complexity about topics delivered fit well with the students' grade level.	4.1	Considerably
	4.4	**Considerably**

4.3 Analysis of Teachers Behavior and Program Quality

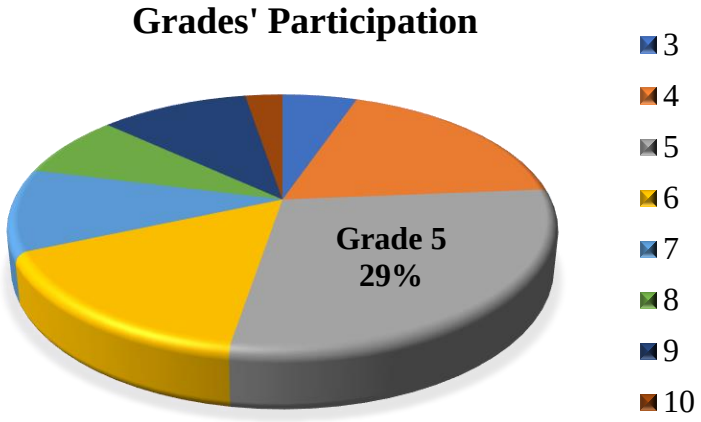
The 4E program was delivered across numerous elementary schools in the City of Calgary. Given that the main goal was to create awareness and change behaviors and attitudes in children and teachers toward energy efficiency and environment, an additional questionnaire was provided to the 48 teachers that received the educative program. Shown in Figure 7, the number of survey responses was 23, representing 48%.

Figure 7 - Teachers' Participation in the Behavior and Program Quality Questionnaire



According to teachers' responses, grades that participated in the different programs belonging to the 4E were from 3 to 10, and grade 5 was the most involved in the 4E program with 11 groups in total (Figure 8).

Figure 8 - Grades' Participation in the different educational workshops of the 4E Program



Like the SEDV residents and facilitators questionnaire, the teachers' questionnaire was not used only to assess their attitude and behavior, but also their perspective about students' after receiving the workshops.

Analyzing the results displayed in Table 14, teachers have gained a reasonable level of understanding of energy and environment topics covered by SEDV residents and facilitators during workshops. Likewise, the 4E program has fairly created awareness on teachers through new knowledge acquired about environmentally sustainable practices, affecting positively their attitude toward minimizing their environmental impact in their everyday life. In this way, with a mean factor of 3.4, it can be said that teachers' attitude toward the environment and sustainable activities has been moderately influenced by these educational programs.

Table 14 - Teachers' Attitude after Receiving the 4E Program

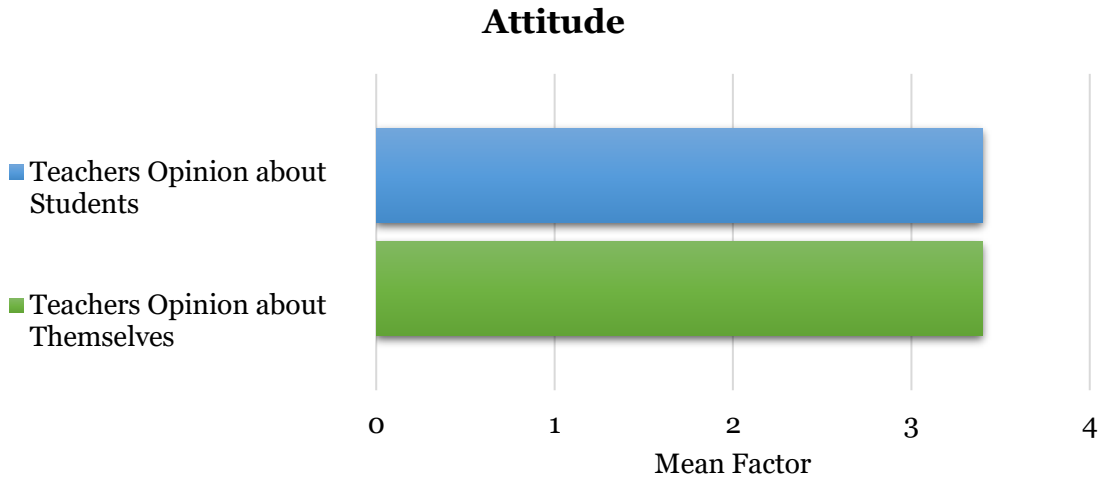
Teachers' Attitude (n = 23)	Mean	Scale
Nature's Ride's Programs improved my understanding of energy-related topics.	3.3	Moderately
I have a greater awareness of my personal role in making energy more sustainable.	3.3	Moderately
I noticed a change in my attitude toward living a life with fewer environmental impacts.	3.6	Considerably
	3.4	**Moderately**

Equally, the result from queries asking for teachers' opinions about students' attitudes and consciousness post-workshops is comparatively similar to their perception about themselves. Observing Table 15, teachers believed that the 4E program improved considerably students' knowledge and comprehension about energy and environment subjects. However, teachers responded that they noticed an average level of engagement from students during each session, as well as improving their awareness and attitude toward energy use and its impact on the environment. Generally, teachers considered that the 4E program moderately affected students' attitudes. These points of view about students describe with exactitude what teachers perceived in themselves about the impact of those workshops in their awareness and attitude, by having the same mean factor of 3.4 (Figure 9).

Table 15 - Teachers Opinion about Students' Attitude after Receiving the 4E Program

Teachers Opinion about Students' Attitude (n = 23)	Mean	Scale
Nature's Ride's Programs improved my students' understanding of energy topics.	3.6	Considerably
My students have a greater awareness of their roles in making energy more sustainable.	3.4	Moderately
I noticed a change in the attitude of the students towards living a life with fewer environmental impacts.	3.3	Moderately
My students appear engaged during the delivery of workshops.	3.4	Moderately
	3.4	**Moderately**

Figure 9 - Comparison of Teachers Opinion about their Attitude and Students' after Receiving Workshops



Another variable evaluated in the questionnaire for teachers is perceived behavior. In this section, teachers expressed having a greater understanding of the extensive natural resources that exist in the Earth; and that to ensure their availability to future generations, those natural resources must be used sustainably. Also, teachers have considerable comprehension of how to act differently to preserve the environment and implement techniques that allow adequate management of its resources. With 4.0 as mean factor, teachers are considered to have significant control over performing a pro-environmental behavior (Table 16).

Table 16 - Teachers Opinion about their Perceived Behavioral Control after Receiving Workshops.

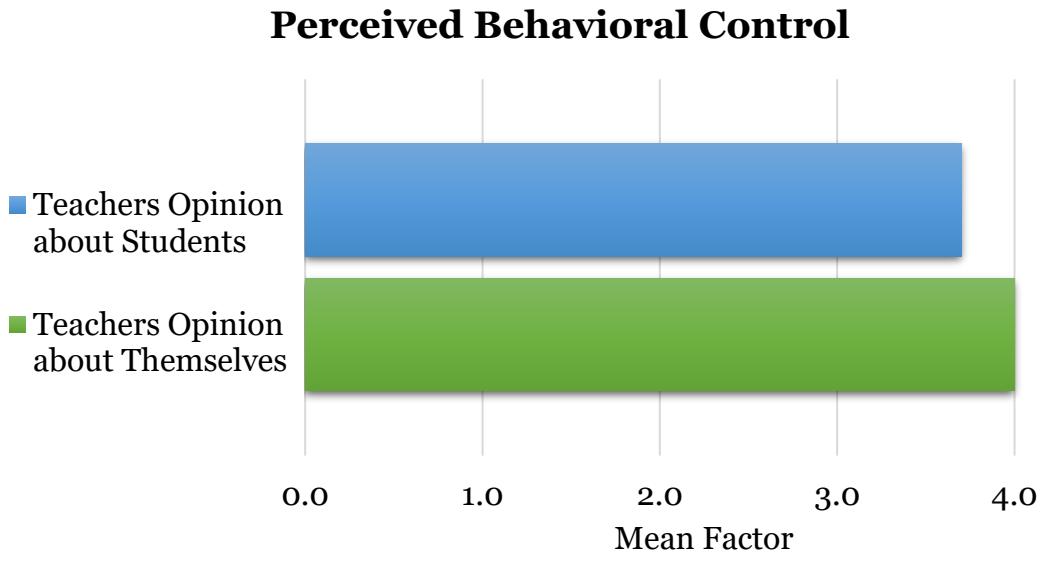
Teachers' Perceived Behavioral Control (n = 23)	Mean	Scale
I know how I can make a sustainable difference.	4.0	Considerably
I comprehended that the Earth has plenty of natural resources if we just learn how to use them sustainably.	3.9	Considerably
	4.0	**Considerably**

Alike, they were asked their opinion about students' perceived behavioral control. Reviewing the results of Table 17, teachers did identify a slightly lower control in students by its mean factor. Yet, like them, teachers believed that students gained a substantial level of knowledge about natural resources useful for humans and the sustainable practices to be applied for their use. Reaching a mean factor of 3.4, teachers still considered that students recognize that they have considerable control over behaving environmentally friendly. Furthermore, in comparison to the attitude section, teachers demonstrated to perceive in students a behavior similar to themselves (Figure 10).

Table 17 - Teachers Opinion about Students' Perceived Behavioral Control after Receiving Workshops.

Teachers Opinion about Students' PBC (n = 23)	Mean	Scale
My students know how they can make a sustainable difference.	3.7	Considerably
My students comprehended that the Earth has plenty of natural resources if we just learn how to use them sustainably.	3.7	Considerably
	3.7	**Considerably**

Figure 10 - Comparison of Teachers Opinion about their Perceived Behavioral Control and Students' after Receiving Workshops.



Subsequently, analysis was performed to determine teachers' opinions about the program quality. As it is stated in Table 18, the overall perception of teachers has resulted in a 3.3 mean factor. Participants of this questionnaire considered that the 4E program has met moderately their expectations by providing diverse topics related to energy and environment with a fair grade of difficulty. Nevertheless, according to suggestions provided in the same survey, some teachers believed that the time spent in each session was

> *"quite short for a deeper understanding of how we can "make sustainable difference" or understanding our roles in understanding how to use natural resources".* (Anonymous Participant, 2020)

Table 18 - Teachers Opinion about the 4E Program Quality

Program Quality (n = 23)	Mean	Scale
Nature's Ride's workshops helped in my daily teaching of the environmental subject matter.	3.1	Moderately
The level of complexity about topics delivered was adequate for students' grade level.	3.1	Moderately
The delivery methods, including the time for each session, were effective.	3.2	Moderately
The program met my expectations.	3.1	Moderately
Considering your complete experience with Nature's Ride's Program, I am likely to recommend this to a colleague or another institute.	3.4	Moderately
Overall, the school benefited from the quality of the programs.	3.6	Considerably
	3.3	**Moderately**

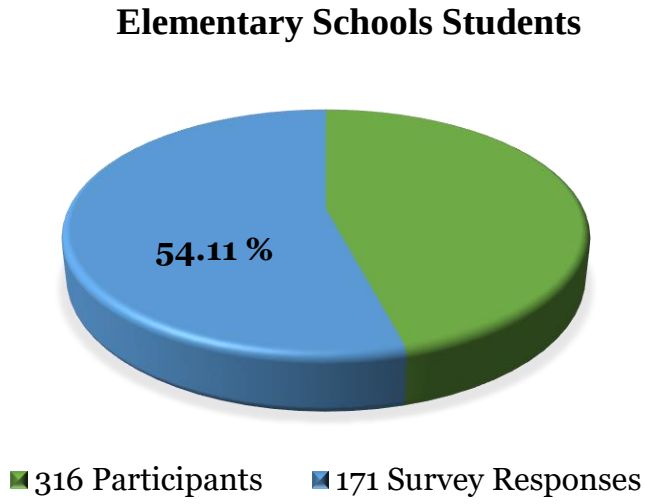
Summarizing all the results obtained from teachers' questionnaire, it is mainly believed that leading teachers (champions who already understood the benefit of environmental education) achieved a better attitude toward the environment and a higher perceived behavioral control to perform an environmentally friendly behavior. Additionally, from personal experience and according to some survey responses, the lack of participation or absence from non-leader teachers affected the improvement of their own attitudes and behaviors as well as the level of engagement from students. Teachers' observations about students' attitudes and awareness after receiving the 4E program appear to correlate with their interest in the workshops. It is important to mention that champion teachers needed to recruit a minimum number of teachers from their school to have the workshops provided in their schools (a requirement set by the 4E program manager).

4.4 Analysis of Students' Awareness Data obtained from Online Sessions

Due to the changing circumstances surrounding Covid-19, the questionnaire applied to elementary school students was carried through online sessions. An assessment was performed to determine their level of knowledge before and after the sessions were

delivered. As the pie Figure 11 shows, 316 students attended online workshops, and 171 provided their responses to the questionnaires done.

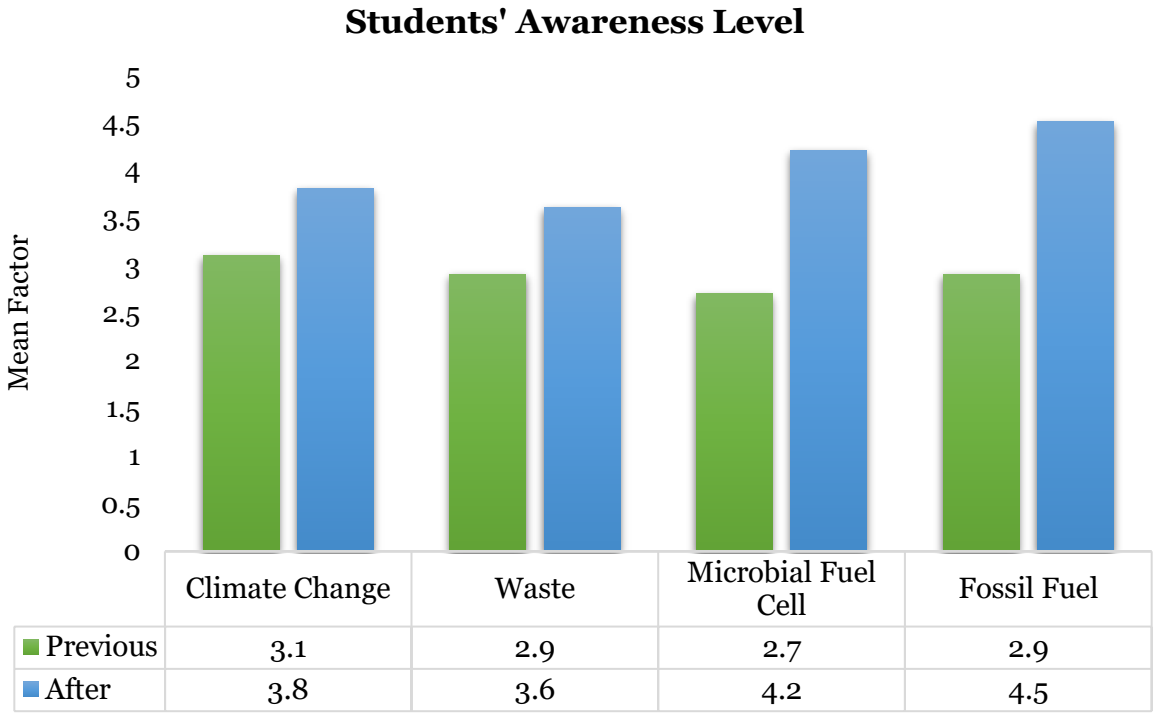
Figure 11 - Participation of Elementary School Students in Online Sessions Conducted during COVID-19.



Topics delivered during those online classes were Climate Change, Waste, Fossil Fuel, and Microbial Fuel Cell. The overall mean factor that represents students' knowledge about these subjects prior to sessions was 2.9 (on a 5-point scale). Nevertheless, their level of knowledge increased to 4.0 after receiving workshops. Figure 12 demonstrates the mean factor for each topic taught, and appendix B displays in detail the value obtained for each question asked in the four different workshops and compares their level of knowledge before and after sections.

In general, it is evident that the educative material delivered through the 4E program has considerably augmented elementary school students' knowledge about the environment and energy efficiency. And according to Hungerford & Volk (1990), the knowledge acquired and behavior-changing are directly linked. Therefore, it might be stated that SEDV residents and facilitators opinions about the level of awareness of students about environmentally sustainable practices is likely accurate.

Figure 12 - Students' Awareness Level before and after Receiving Online Sessions

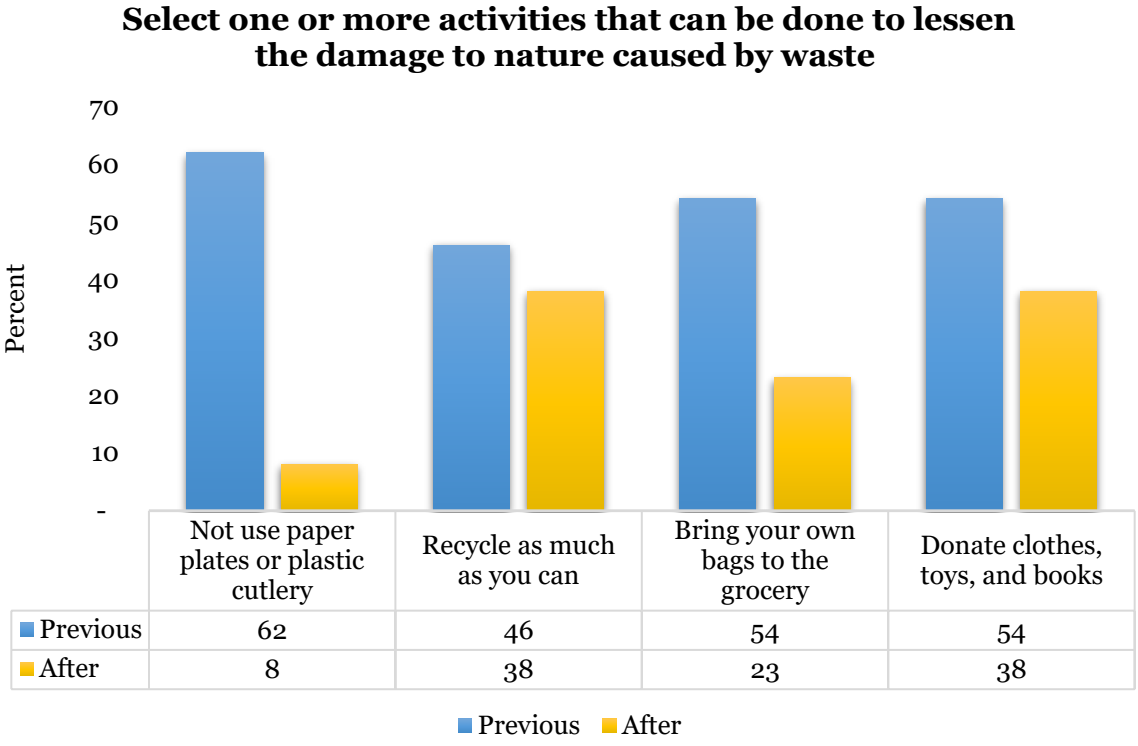


	Climate Change	Waste	Microbial Fuel Cell	Fossil Fuel
Previous	3.1	2.9	2.7	2.9
After	3.8	3.6	4.2	4.5

Yet, despite the fact that students exhibited a knowledge increase in the Waste topic, from a mean factor of 2.9 to 3.6, a contradictory result was observed in the last question of that survey. This was about selecting one or more activities that can be done to lessen the damage to nature caused by waste, as Figure 13 shows. Prior to the session, students' responses indicated that they had a great understanding of those activities that can mitigate the environmental impact such as recycling, always bringing their own shopping bags, not using plastic cutlery or paper plates, and donating clothes. Nonetheless, students' answers to the mentioned question after receiving the online session was completely different, displaying a significant lower knowledge about the explained activities.

It is presumed that the specified question was not completely clear for elementary school students that participate in online workshops. Furthermore, after reviewing new material content delivered in that session, it is believed that they might have selected the option that they considered as the most important activity to be done to reduce the damage caused to nature.

Figure 13 – Results' Variation about the Question related to Waste Session



Chapter 5: Conclusions and Recommendations

5.1 Conclusion

The deterioration of the environment is one of the most concerning issues that we are experiencing nowadays. Beyond implementing solutions for the short-term, it is important to identify the main root of the problem, human behavior. Hungerford and Volk (1990) have stated that environmental education plays a significant role when it comes to influencing behavior change.

That children are more receptive to environmental education is crucial for improving our planet's future. Yet, it is also essential to determine the impact that it has on changing children's awareness and behavior toward the environment. Therefore, this research was developed to assess the effect that educative material offered by Nature's Ride had on changing awareness and behavior toward environmentally sustainable practices. The study was carried out with elementary school students and teachers who received the education program and with SEDV residents and facilitators who delivered it. Through the 4E program developed by Nature's Ride, educative programs related to the environment and energy efficiency were delivered in 12 elementary schools across the City of Calgary to create consciousness and change behavior in children toward these subjects.

Using the Theory of Planned Behavior developed by Ajzen (1990), questionnaires were designed to assess the attitude and perceived behavioral control of participants. Moreover, SEDV residents and facilitators' opinions, and teachers' perceptions about elementary school students' attitudes, perceived behavioral control, and awareness was assessed. SEDV residents and facilitators, as well as teachers, were asked to identify any impact on themselves after receiving workshops.

Through the analysis of the results obtained, it can be concluded that across the environmental education workshops delivered in the elementary schools, the students' level of awareness toward the environment enhanced significantly. The outcome showed that students have gained a better comprehension of making different actions that

contribute to sustainable development. This can be said not only by the elementary school students' awareness level outcome but also as perceived by SEDV residents and facilitators who had a higher level of interaction with them during each session. In the same way, delivering those workshops complemented considerably SEDV residents' and facilitators' knowledge about sustainable development.

Furthermore, SEDV residents' and facilitators' and elementary school students' attitudes have been positively impacted by understanding the benefits that bring practices such as reducing energy consumption, selecting renewable energy sources, using water efficiently, generating less garbage, and more to preserve the environment and improve the quality of life globally. Equally, it was observed that teachers' attitudes were also influenced by the 4E program, however, at a lower level. This is believed to be due to the lack of knowledge or concern about the environment and sustainability by some teachers (non-champion teachers), demonstrating less interest in participating in each session that was delivered.

In consequence, it was clearly observed that the viewpoint of SEDV residents and facilitators about students' attitudes and behavioral control was reflected in their own perception about themselves. Similarly, teachers demonstrated a parallel result, believing that students' attitudes and knowledge improved slightly. Nevertheless, students showed a significant increase in the level of knowledge after attending the 4E program offered through online sessions. Therefore, it can be confirmed that students from grade 3 to 10 are capable of learning about energy and the environment. As well, it may be deduced that SEDV residents and facilitators did perceive correctly an improvement in students' knowledge. The engagement and passion for the environment that SEDV residents and facilitators have may have led them to give credit to the students' attitudes as more favorable after the program.

From a general point of view, through these findings, it can be stated that the 4E program contributed to generating better behavioral control for participants by creating a greater awareness on students and SEDV residents and facilitators by making energy more sustainable through performing straightforward activities that minimize the

environmental impact. On the other hand, according to SEDV residents' and facilitators' perception, students gained a broader understanding of their abilities to make a sustainable difference, taking into consideration the necessities that future generations will have.

By gaining more knowledge and an extended comprehension of environmentally sustainable practices, students, teachers, and SEDV residents and facilitators achieved a more favorable attitude toward those practices and better behavioral control over performing those. This leads them to have a stronger intention of behaving in a more environmentally friendly manner, confirming what has been stated by Ajzen in the Theory of Planned Behavior (1990). Also, the outcome achieved from this research contributes to certain parts of the investigation performed by Niaura in his research about using the Theory of Planned Behavior to investigate the determinants of environmental behavior among youth (2013), where the author found the strong effect that attitude and intention have over behavior. The implementation of environmental education can certainly impact positively children's behavior toward the environment. In accordance with Ajaps and McLellan (2015), these results have demonstrated that perhaps environmental education cannot completely achieve the aimed behavior, but it has shown that reasonable increased knowledge may stimulate changed behavior toward it.

In addition to that, SEDV residents and facilitators' leadership qualities developed during their participation in the 4E program were determined through the competency values framework. The outcome obtained from this evaluation demonstrated that participants developed leadership qualities during the planning, preparation, and developing stages of the 4E program, establishing a commitment to achieve expected outcomes. Additionally, the empowerment provided to facilitators and residents allowed them to strengthen teamwork, supporting each other during the program development. Hence, SEDV residents and facilitators displayed skills that allow to take action for any opportunity that may arise to achieve the expected outcomes.

5.2 Limitations

The limitations of this research are described in the following paragraphs. Initially, one of the bounds was time. For conducting research, it is important to recognize timeline as a key factor. Due in the initial phase are necessary permissions which must be obtained to investigate in areas that involve schools and children. The subjective norm variable was not evaluated due to the short period available for carrying out this research as it is related to the impact that relatives, friends, etc., have over people performing a behavior.

In addition to that, the COVID-19 pandemic affected the delivery methodology executed in workshops. The 4E program had been delivered in classrooms prior to the pandemic. Based on these unexpected circumstances, the methodology had to be adapted to a new delivery style. By teaching workshops online, some learning activities were restricted to the demonstration, and the number of students that participated in sessions decreased. Furthermore, the poor engagement from non-leader teachers might have affected the impact of educative material had on students, as they showed less concern about the environment and sustainable practices.

5.3 Recommendations and Future Research

Based on the analysis of the results obtained in this research, some recommendations emerged to continue studying pro-environmental behavior change. It is suggested to start with an engagement stage that involves every teacher who will be receiving the 4E program. This is fundamental to raise more awareness in teachers as many of them may not be familiar with environmental practices. Also, it is considered a relevant strategy to achieve more consciousness in children and modify their behavior toward the environment.

As well, it is recommended to include environmental education in the school curriculum to achieve a higher level of awareness in students. Still, taking into consideration different learning dynamics for each grade that will receive the program and adapting its complexity according to their grade. This plan of action might improve students'

engagement and knowledge level acquired. Furthermore, it is highly advisable to perform a pre-assessment to determine each permission necessary to carry out research of this type and minimize possible limitations during the process that it may cause.

Among recommendations for future research, behavior change might be investigated for a longer period. It will allow evaluating all three variables implemented by the Theory of Planned Behavior at a higher scale. Moreover, consider diverse areas that can be explored concerning the subject, for instance, the impact of environmental education in different grades. As well, it would be fruitful to compare the behavior change between schools that offer conventional lessons and schools with environmental education in their curriculum. Otherwise, evaluate the effect of the application of hands-on lessons in the learning methodology. Finally, assess the impact that may generate more undertakings from teachers on changing children's attitudes and behavior toward environmental practices.

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Appendix A: Elementary School Students' Awareness Level Questionnaire

Questions implemented to evaluate the level of knowledge of elementary school students that participated in the 4E program online.

Climate Change
How much you know about climate change?
How much you know about the natural causes of climate change?
How much you know about things that humans do that affect climate change?
How much do you know about things that humans can do to stop the damage from climate change?
Fossil Fuel
How much do you know about types of fossil fuels?
How much do you know about producing energy from fossil fuels?
How much do you know about the damage to nature (air, water, and land) caused by human activities?
How much do you know about things you can do to stop damage to nature?
How much do you know about using natural resources so there is plenty for everyone?
Microbial Fuel Cell
How much do you know about Microbial Fuel Cells?
How much do you know about producing energy from bacteria?
How much do you know about the damage to nature (air, water, and land) caused by people's activities?
How much do you know about things you can do to stop damage to nature?
Waste
How much do you know about how to generate less amount of waste?
How much do you know about organic and inorganic waste?
How much do you know about the damage to nature (air, water, and land) caused by human waste?

Source: Author, 2020

Appendix B: Results of Elementary School Students' Awareness Level Questionnaire

Comparison of mean factors obtained about students' level of knowledge previous and after the Climate Change workshop

Climate Change	Previous	Scale	After	Scale2
How much you know about climate change?	3.3	Some	3.9	Quite a bit
How much you know about the natural causes of climate change?	2.8	Some	3.6	Quite a bit
How much you know about things that humans do that affect climate change?	3.3	Some	3.8	Quite a bit
How much do you know about things that humans can do to stop the damage from climate change?	3.2	Some	3.9	Quite a bit
Overall	**3.1**	**Some**	**3.8**	**Quite a bit**

Source: Author, 2020

Comparison of mean factors obtained about students' level of awareness previous and after the Fossil Fuel section

Fossil Fuel	Previous	Scale	After	Scale
How much do you know about types of fossil fuels?	2.8	Some	3.7	Quite a bit
How much do you know about producing energy from fossil fuels?	1.9	A little bit	2.4	A little bit
How much do you know about the damage to nature (air, water, and land) caused by human activities?	3.4	Some	4.2	Quite a bit
How much do you know about things you can do to stop damage to nature?	3.1	Some	3.8	Quite a bit
How much do you know about using natural resources so there is plenty for everyone?	3.1	Some	3.8	Quite a bit
Overall	**2.9**	**Some**	**3.6**	**Quite a bit**

Source: Author, 2020

Comparison of mean factors obtained about students' level of knowledge previous and after the Microbial Fuel Cell workshop

Microbial Fuel Cell	Previous	Scale	After	Scale
How much do you know about Microbial Fuel Cells?	1.8	A little bit	3.9	Quite a bit
How much do you know about producing energy from bacteria?	2.0	A little bit	3.9	Quite a bit
How much do you know about the damage to nature (air, water, and land) caused by people's activities?	3.6	Quite a bit	4.6	A lot
How much do you know about things you can do to stop damage to nature?	3.3	Some	4.5	A lot
Overall	**2.7**	**Some**	**4.2**	**Quite a bit**

Source: Author, 2020

Comparison of mean factors obtained about students' level of knowledge previous and after the Waste workshop

Waste	Previous	Scale	After	Scale
How much do you know about how to generate less amount of waste?	2.6	Some	4.2	Quite a bit
How much do you know about organic and inorganic waste?	2.8	Some	4.6	A lot
How much do you know about the damage to nature (air, water, and land) caused by human waste?	3.2	Some	4.7	A lot
Overall	**2.9**	**Some**	**4.5**	**A lot**

Source: Author, 2020