Effectiveness of Waste Education: A Mixed Methods Analysis of the Litter Less Campaign

by

M. (Madeleine) Vollebregt

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Delft student number: 5188954
Leiden student number: 2465019

GRADUATION COMMITTEE
Primary supervisor: Dr. K. Mulder
Secondary supervisor: Dr. W. Peeters
External supervisor at FEE: Dr. S. Ginzburg

Abstract

Waste education programmes, such as the Littler Less Campaign (LLC), are environmental and sustainability education (ESE) programmes which aim to increase the understanding of one's impact on the environment and the impact of the environment on society. The LLC aims to increase waste literacy, which is a measure of a person's understanding of waste pathways and the effects of anthropogenic waste on the environment. Waste literacy plays an important role in the field of industrial ecology as it has demonstrable effects on whether individuals are willing and able to participate in environmental responsible behaviors (ERBs). Previous studies have shown that it is necessary to increase the public's understanding and awareness of environmental issues, and primary education is a critical time for shaping ERBs.

This thesis uses mixed methods to analyse how the LLC affects aspects of waste literacy and how teachers and national operators perceive the LLC's effects. Multivariate data analysis is used to analyse LLC students' knowledge of waste and attitudes towards waste and the factors affecting the LLC's impact. The results show that the LLC has a significant effect on the students' attitude toward waste and knowledge of waste in Northern Ireland and Russia, but not in Ireland. Gender and age did not affect LLC students' scores, but female control students had higher knowledge and attitude scores compared to male control students while younger control students had higher attitude scores compared to older control students, suggesting that the LLC decreases the effect of background factors on waste literacy. The perceptions of teachers and National Operators (NOs) were analysed using thematic analysis and results showed both teachers and NOs thought the LLC had a positive impact on students overall and that student involvement determined the effectiveness of the LLC. Participatory teaching methods, specifically fieldwork and student ownership, were found to play a significant role in the LLC's efficacy.

Keywords: waste literacy, multivariate data analysis, thematic analysis, participatory methods.

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Abbreviation list

ESE: environmental and sustainability education

EL: environmental literacy

ERB: environmentally responsible behavior

LLC: Litter Less Campaign

FEE: Foundation for Environmental Education

ES: Eco-Schools

YRE: Young Reporters for the Environment

LEAF: Learning About Forests

NO: national operator

CATPCA: categorical principal component analysis

MANOVA: Multivariate analysis of variance

1. Introduction

1.1 Problem introduction

Europe, along with other advanced economies, is not meeting the European Union's 2050 vision. To achieve the goals laid out in the environmental plan, changes in lifestyles, production, consumption, knowledge and education are required (European Environmental Agency, 2019). Hungerford and Volk (1990) write, "the ultimate aim of education is shaping human behavior" (p. 257); environmental and sustainability education (ESE) aims to shape environmental behavior through the development of environmental literacy (EL), which is the understanding and motivation to make responsible decisions that consider relationships with natural systems and future generations (McBride, Brewer, Berkowitz, and Borrie, 2013). ESE goes beyond the presentation of information as it includes education in the environment, about the environment, and for the environment (McBride et al., 2013). While traditional education normally targets specific learning levels, ESE applies to all ages, and it includes attitude and behavior components, in addition to knowledge components (McBride et al., 2013; UNESCO, 2018).

To reverse global environmental degradation, a multitude of initiatives and programmes have been created which typically address a specific environmental issue; direct responses have included climate change treaties and carbon markets in response to global warming while other efforts address the loss of biological diversity, ecosystem services degradation, and natural resource management. The existence and efficacy of these programmes depend on an environmentally literate society who care about the environment, understand ecology, and can participate in environmentally responsible behavior (ERB). Waste literacy campaigns are a form of ESE targeting anthropogenic waste by intervening in waste pathways with behavior-based solutions (Willis, Maureaud, Wilcox, and Hardesty, 2018). These programmes typically address waste prevention and removal rather than waste production (i.e., plastic production) (Willis et al., 2018). Littering is a common topic of ESE programs as it results in social and

environmental costs at the local and global scale, but also because it is a tangible environmental issue which is widely encountered (Heidbreider et al., 2019).

1.2 Case study selection

The Litter Less Campaign (LLC) is a waste literacy program which educates students about litter and waste with the goal of knowledge, attitude, and behavior change (Eco-schools, n.d.). The programme began in 2011 and it is an initiative between the Foundation for Environmental Education (FEE) and the Mars Wrigley Foundation. FEE is non-governmental and non-profit organization that has been promoting sustainable development through environmental education since 1994 through five programmes: Green Key, Learning about Forests (LEAF), Young Reporters for the Environment (YRE), Eco-Schools (ES), and Blue Flag (FEE, n.d.). These programmes aim to empower students to be the change needed for a sustainable world and they engage students with action-oriented learning. The LLC is implemented in 15 countries through the ES and YRE programmes: Australia, Brazil, China, England, France, India, Ireland, Kenya, Malta, Northern Ireland, New Zealand, Russia, Scotland, Spain, and Wales (Eco-schools, n.d.). This study examines the effects of the LLC on students in Ireland, Northern Ireland, and Russia.

1.3 Societal and scientific relevance

Industrial ecology (IE) strives to strike a balance between environmental sustainability and industrial production and consumption. It works to address environmental issues by improving the use of resources and preventing the overuse of raw materials. However, according to Fletcher and Potts (2007), many environmental problems exist at a geographic scale larger than the nation state and greater than the scale at which individuals operate, making it difficult for individuals to comprehend these issues. If citizens cannot understand and accept the scientific evidence behind environmental problems such as unsustainable consumption or climate change, prevention and mitigation efforts are unlikely to be successful (Tobler, Visschers, & Siegrist, 2012). Waste education programmes are critical as they equip individuals to address waste issues by raising awareness of the two-way interactions between the

environment and people's daily consumption (McBride et al., 2013). Waste literacy is needed to address consumption issues and achieve IE goals as it enables individuals to make responsible decisions and support good public policy.

A concern of the LLC and ESE programmes more generally, is programme effectiveness. ESE programmes are often asked to demonstrate their results, which usually determines their funding. Ardoin, Bowers, Roth, and Holthuis (2017) found that the number of published articles focused on measurable student outcomes in ESE has increased steadily and suggest that this growth may reflect an increasing emphasis on measurable outcomes in ESE, but programme monitoring, and evaluation can still be a challenge for ESE programmes due to unclear objectives, limited research approaches, and unarticulated programme theory (Monroe, 2010; Andriamalala, Peabody, Gardner, & Westerman, 2013). This thesis takes a mixed-methods approach to explore the effects and perceptions of the LLC in the 2020-2021 school year. This research is useful to ESE educators and programme managers as it presents an example of waste education and explains the successes and shortcomings of the programme in three different countries. Additionally, this study can be used an example for programme evaluation. It quantitively analyses the effect of the LLC on waste attitudes and waste knowledge of LLC students in Ireland, Northern Ireland, and Russia and student attributes (age, gender, and nationality) are accounted for. The perceptions of teachers and National Operators (NOs) are then examined qualitatively to determine what aspects of the LLC are effective. In a wider view, this research supports global waste literacy as it supports further development of ESE.

1.4 Research questions

Based on the problem statement and knowledge gap the following main research question is created:

How does the Litter Less Campaign affect students' waste literacy?

The corresponding sub questions are as follows:

1) Is there a significant difference in waste attitudes between the LLC and non-LLC students?
2) Is there a significant difference in waste knowledge between the LLC and non-LLC students?

3) How do background variables (gender, age, and nationality) affect waste knowledge and waste attitude scores?
4) What aspects of the LLC are effective or ineffective according to LLC teachers and national operators?

1.5 Report structure

In the following chapter, the theoretical framework is presented in which EL, ESE, and the LLC are explained. Chapter 3 presents and explains the chosen methodology. Chapter 4 analyses and discusses student questionnaire responses. Chapter 5 analyses and explains the perspectives and practices of LLC teachers and chapter 6 analyses the perspectives of national operators. In chapter 7 the results are discussed in a wider context and recommendations for the LLC and ESE are made. Finally, in Chapter 8 a conclusion is presented, and recommendations are made for future research.

2. Theoretical framework

2.1 History and background of ESE

ESE goals were first introduced in the Belgrade Charter in 1975 at the UNESCO Conference in Yugoslavia (UNESCO, 1975). Following Belgrade, the world's first Intergovernmental Conference on Environmental Education was held in Tbilisi, Georgia and resulted in the Tbilisi Declaration, which detailed descriptions of the objectives of environmental education which have been widely accepted by environmental educators (UNESCO, 1975). Objectives included awareness, knowledge, attitude, skills, and participation (UNESCO, 1978). Well-designed environmental education programmes can lead to the desired outcomes conveyed in The Belgrade Charter and Tbilisi Declaration but to achieve those goals, they must focus on motivating learners to engage in environmentally responsible behaviors (ERBs) (Venkataraman, 2008). ERBs occur when an individual aims to do what is right to help protect the environment in daily practice (Cottrell, 2003).

Previous research on ERBs comes from human behavior theory and draws upon theories such as the norm activation model (Schwartz, 1977), the theory of reasoned action (Ajzen & Fishbein, 1980), and the theory of planned behavior (Ajzen, 1991). Ajzen and Fishbein's (1980) model of reasoned action suggests that the individual's intention to act has a direct effect on behavior. Models, which often became known as the Knowledge-Attitude- Behavior or K-A-B Model, examine the interactions between sociodemographic, cognitive, psychological, situation, emotional, and social situational predictors of ERB (Marcinkowski and Reid, 2019; Cottrell, 2003; Hines et al., 1987). The knowledge component of environmental literacy includes (1) understanding ecological principles and the effect of humans on natural systems, (2) the interrelationship between social systems and natural systems and environmental issues caused by these complex interactions, and (3) environmental action strategies, including the ability to evaluate remediation options (Hine et al., 1987; UNESCO, 1978).

Hines at al. (1987) performed a meta-analysis of 128 studies and identified variables that have shown repeated correlation with positive environmental behavior. Factors leading to ERB are depicted in Figure 2.1. Knowledge of the issue, positive attitudes towards the environment, locus of control and desire, or intention to act, were causally related to ERB (Hines et.al, 1987). Environmental attitude can be defined as general feelings or concern toward the environment or environmental issues and locus of control is an individuals' perceptions of their ability to cause change through personal behavior (Pe'er et al., 2007). If an individual attributes change to external factors, and not to personal behavior, they will be less inclined to influence a situation. People who believe in their ability to cause change through personal actions have internal locus of control (Pe'er et al., 2007). An important result of environmental literacy is the empowerment of a person's belief in their ability to contribute to environmental solutions.

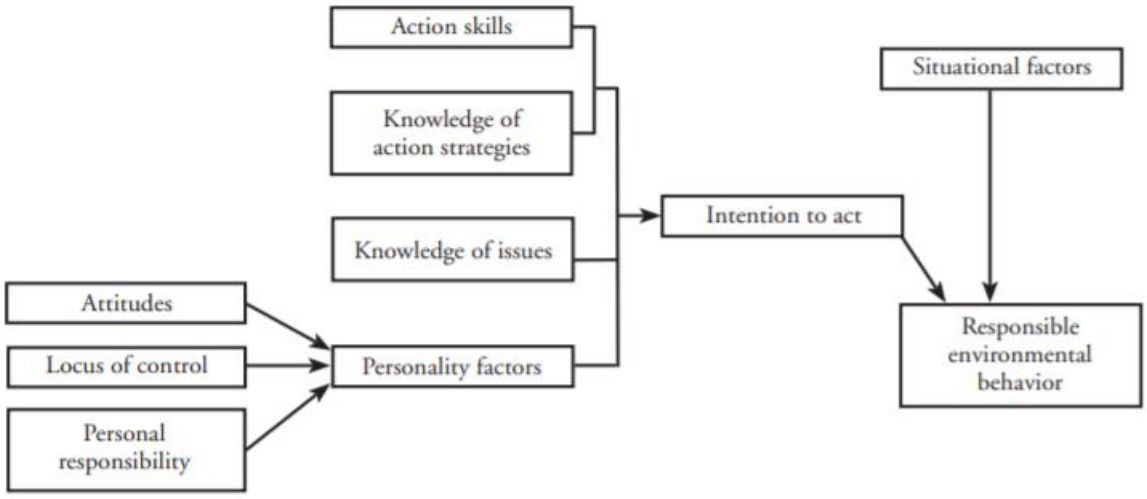

Figure 2.1. *Factors leading to ERB (Darner, 2009).*

Many evaluations of environmental education have focused on knowledge gains and attitude changes with the assumption that a linear relationship exists between increased environmental knowledge and positive environmental behavior but not all previous studies agree on this relationship (Darner, 2009; Hungerford & Volk, 1990). Kraus (1995) and Wallace et al. (2005) found in their meta-analyses that while an attitude-behavior relationship may be statistically significant, it usually has only moderate

strength (Cohen, 1988). Results of meta-analyses by Hines et al. (1987), and Bamberg and Moser (2007), which also studied attitude-behavior relationships also agreed with these findings.

Alternatively, there is also evidence that environmental behaviors reflect environmental literacy (Bradley, Waliczek, & Zajicek, 1999; McMillan, Wright, & Beazley, 2004; Pe'er et al., 2007). Researchers have shown that increasing an individual's environmental knowledge through ESE results in more positive attitudes toward the environment and more responsible environmental behavior (Bradley, Waliczek, & Zajicek, 1999; McMillan, Wright, & Beazley, 2004; Hsu, 2004). Knowledge is a critical component of environmental literacy but, knowledge alone is not a sufficient precursor for responsible environmental behavior (Hungerford & Volk, 1990; Tudor, Barr, & Gilg, 2009). Informing people and raising awareness are an essential part of changing perceptions and behavior but does not necessarily result in attitude or behavior change (Fauville et al., 2019). While not always successful, attempts at behavior change through ESE are needed to reverse environmental degradation as consumption patterns, waste management practices, and support or engagement in the implementation of environmental policies affect environmental degradation (Ashley et al., 2019; Hartley, 2018).

2.2 ESE methodology and integration

ESE learning methods differ from conventional methods in that they are typically interdisciplinary and holistic, values-driven, forward-looking, locally relevant, global minded, critically thinking, participatory, and learner-centered (Alampei, Malotidi, Psallidas, & Scoullos, 2013). Participatory teaching methods which include discussions, presentations, fieldwork, experiments, and co-operative learning, are particularly effective in making students reflect on their own ESE learning as they promote competencies such as critical thinking, imagining of future scenarios and collaborative decision-making (Alampei et al., 2013). Fieldwork is a large part of most ESE programmes as it is cited as a particularly effective participatory method in addition to first-hand experiences and field trips (Jeronen, Palmberg, & Yli-Panula, 2017; Corney and Reid, 2007). Jeronen et al. (2017) highlight the value of inductive teaching methods with learner-centered approaches and found that fieldwork had positive

effects on the sustainability attitude and behavior of students. ESE's use of emotive approaches has also been found to foster self-awareness, social awareness and environmental awareness (Littledyke, 2008). These methods can be seen in FEE's programmes and the LLC curriculum; the LLC lesson plans use a learner-centered approach which includes discussion and group work to investigate waste habits (FEE, 2020).

ESE curriculum varies around the world, and it has been studied in several countries (Green & Somerville, 2015; Fraser, Gupta, & Krasny, 2015; Kimaryo, 2011; Olsson, Gericke, & Chang-Rundgren, 2016; Sund, 2016; Uitto & Saloranta, 2017). Green and Somerville (2015) found that Australian ESE teaching methods focus on four sets of relations: the materiality of school grounds, connections with local places, partnerships with the community, and creative processes. In Tanzania, primary school teachers perceived ESE as providing knowledge about the environment (Kimaryo, 2011). Sund (2016) found that Swedish teachers utilised the curriculum and implemented pedagogy differently based on their subject. Science and history/civics teachers connected the affective aspect of sustainability by considering responsibility, equity, and fairness to others as important factors of sustainability issues. Historical and contextual aspects of sustainability were also emphasised by history and civics teachers (Sund, 2016). Uitto and Saloranta (2017) highlight that a teachers' awareness of their own ESE competence was important in their teaching of interdisciplinary ESE. Each subject teacher group had specific ESE strengths and weakness in ESE; biology, geography, and history teachers used holistic approaches. Religion, art, and physical health teachers did not use a holistic approach but considered two or three ESE dimensions while math, physics, chemistry, and language teachers included only one ESE dimension (Uitto & Saloranta, 2017).

The Organization for Economic Cooperation and Development (OECD) notes that the development of ESE programmes is slow, and implementation varies widely by region (Hanisch, 2014). EL topics are multidisciplinary as they connect to social and economic problems, as well as scientific issues and they can relate to nearly every primary school subject, yet many teachers and schools do not include ESE in their curriculum. Corney (2006) found that teachers have difficulty in understanding

sustainability concepts because of their complexity and the interrelation between concepts. Teachers have also been found to have limited understanding of sustainability content and principles resulting in a focus on local and national issues while global issues are ignored or underestimated (Spiropoulou, Antonakaki, Kontaxaki, & Bouras, 2007). Green and Somerville (2015) also reported that teachers did not understand the concept of sustainability and could not integrate sustainability into an already overcrowded curriculum. Kabadayi (2016) found that for teachers to integrate sustainability into the curriculum, they must be active curriculum planners. Resistance to change and lack of environmental policies were also found to be barriers to effective implementation of ESE (Kanyimba, 2002). Other barriers include teacher's personality, the prevailing school climate regarding the use of teaching methods and a lack of support from the school principals (Summers et al., 2005). Many teachers are willing to develop their teaching and work in an interdisciplinary way, but they feel that they do not have time and knowledge, skills, and resources (Summers et al., 2005). These barriers to ESE which explain why it has become common for schools and teachers to use external ESE programmes such as the LLC. Supplemental ESE programmes are useful, but they vary widely, and education standards are an important tool for supporting progress in ESE and science education more generally (Schoedinger et al., 2005). If ESE and waste education are included in science education standards of the future, then textbook publishers, curriculum developers and assessment specialists will also incorporate these topics, making them more widespread (Schoedinger et al., 2005). ESE standards would also encourage more thorough ESE training for teachers.

2.3 LLC methodology and implementation

The LLC is a response to the issue of litter and waste and objectives of the campaign are: (1) to raise awareness of the effects of litter and waste on the local environment and wider community, (2) to improve students' behavior regarding the prevention and management of litter and waste, and (3) collaborate with other schools to disseminate good examples for dealing with littering and waste (Eco-Schools, 2020). ES and YRE have their own additional objectives. For ES these are: (1) to increase

students' knowledge and practical skills in preventing and managing litter and waste, (2) to promote and improve the schools' waste management systems, and (3) to illustrate good examples using photos and descriptions shared on the LLC website. Additional objectives for YRE are: (1) to report on issues related to litter and waste in the local community and suggest solutions through articles, photographs, and videos, and (2) to act as opinion leaders and through dissemination of reports and discussion of litter and waste using various media (FEE, 2020).

The ES programme represents the largest international network of students and teachers and has been recognised by the UN Decade of Education for Sustainable Development (DESD) (2005–2014) and by UNEP as a model programme for ESE (Eco-Schools, 2020). The programme uses a whole-school approach with their Seven Steps Framework which can be seen in Figure 2.2 (FEE, 2020). Students are responsible for leading the Eco-Committee (EC) at their school and are included in the decision-making processes of dealing with their local sustainability issues (Eco-Schools, 2020). Each school is required to make a litter and waste review to evaluate their waste situation and find which sustainable development goals (SDGs) can be linked. An action plan is then made by schools to reduce litter and improve waste management. The action plan and measurement are evaluated throughout the school year. Action plan goals are linked to the curriculum and an Eco-code or Eco-Vision are created. Lastly, each school implements one Community Action Day involving parents, local stakeholders, and Wrigley associates; examples include *Walk to School Week*, an *Eco-Open Day* where parents are invited to present achievements, or a *Low Energy Day* which focuses on energy conservation. All Eco-Schools also collaborate with a school in another country. Schools are entitled to receive the Green Flag for good practices of the ES programme (Eco-Schools, 2020).

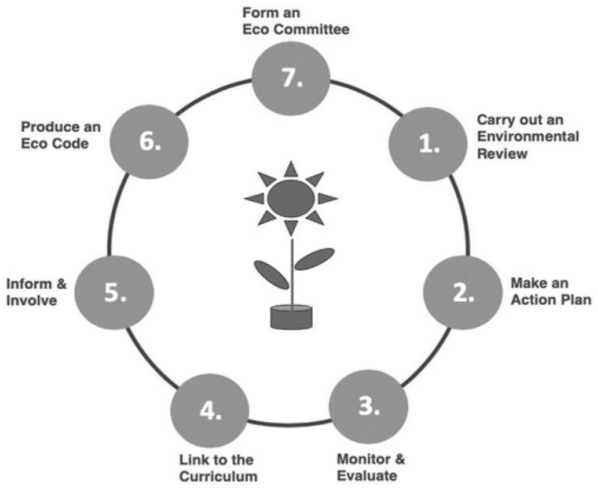

Figure 2.2. *The Seven Step Framework of the Eco-Schools Programme (FEE, 2020).*

YRE is a smaller programme compared to ES and it is intended for students aged 11-15. It aims to educate students on environment-focused citizen journalism, to encourage investigation and reporting of local environmental issues and solutions. When the LLC is implemented through YRE students are required to investigate a local waste issue and create a journalistic project. The programme aims to develop participants' skills and knowledge about the environment, enhance their communication and citizenship skills, individual initiative, teamwork, critical analysis, social responsibility, and leadership abilities.

YRE uses a four-step methodology: (1) identification and investigation of a local environmental issue; students are expected to conduct original research and link their chosen issue to the larger global picture, (2) identification of solutions using experts and stakeholders; students are expected to identify the pros and cons of each solution and must be justified, (3) students target their audience and select a way to reach them; they must select a form of media and take a positive approach to finding a solution for their issue, (4) sharing their work with a local audience through any type of media channel (YRE, n.d.). Community Action Days are also a part of the YRE methodology.

Each participating country has one organisation who cooperates with FEE and is responsible for the implementation, monitoring, and certification of the LLC and other FEE programs (FEE, 2020); this

organisation is known as the National Operator (NO). The NO identifies a litter challenge of the country e.g., balloons, plastic litter, street litter, marine litter etc. and this becomes the recommended topic for each country. The NO then selects ten LLC lesson plans that schools can choose from for that year. Each school selects three lesson plans out of the chosen ten that relates to the waste problem at their school or community. The implementation varies greatly among the different countries, from light ad-hoc projects and environmental management-oriented approaches to more systemic integrative approaches (Cincera et al. 2018). The programme exposure time is one year and is based on the methodologies of the ES and YRE and designed for ES students ages 6-12, and YRE students aged 11-18 (FEE, 2020).

The LLC curriculum materials include lesson plans, the LLC Handbook, Guidelines for Monitoring Litter and Waste in school, the LLC Home Challenge, the YRE and ES websites, and video tutorials and webinars. The LLC lesson plans are developed by CEE and are the key part of the curriculum along with the waste monitoring activity. CEE claims that their education materials foster active citizenship, critical thinking, ethical decision-making, and understanding the interconnectivity of SDGs (FEE, 2020; CEE, n.d.). The lesson plans were created with a set of objectives (CEE & FEE, 2018):

- To raise awareness about litter and waste and its effect on the local environment
- To increase students' knowledge and change attitudes for preventing and managing litter and waste
- To influence students' behavior in preventing and managing litter and waste
- To assess the waste literacy of students
- To enable students to disseminate and exchange examples of work achieved in the context of litter and waste management

The lesson plans are for 6- to 16-year-olds and are meant "to enable teachers to guide students systematically and bring about litter and waste related learning and change in schools, and the community through the meticulous planning, innovation, and action" (CEE & FEE, 2018). The lesson plans are built

on the ES and YRE methodology and cover the following topics: cycles in nature, waste management, litter, packaging, sustainable consumption, learning to be an environmental journalist, waste health and global issues, sustainability and waste, marine waste, E-waste, and global treaties, policies, and legislations pertaining to waste (Eco-Schools, n.d.). An example of a lesson plan can be seen in Appendix A. Schools are supposed to use three of the provided lesson plans but not all countries use them as they are not available in all languages and some teachers choose topics which are not on the topic list.

In addition to three lesson plans, schools are required to monitor the amount of litter and/or waste on campus. From the following criteria one is chosen for monitoring: (1) amount of litter found in the school yard, (2) amount of litter and waste collected in the school, (3) amount of paper collected in the school or classrooms, (4) amount of waste segregated (recycled) in the school or classrooms, or (4) in the case of school lockdown, record the amount of waste segregated at home. The measurement is done in kilograms and six measurements were originally asked for but because of the Covid-19 pandemic most schools could not complete more than four (Eco-schools, 2020). The goal of this activity is to assess the effect of the LLC on student behaviour in relation to littering, recycling and waste prevention while providing an educational exercise. While this activity has educational value, it cannot be relied upon to accurately assess the programme's impact due to external factors that impact litter and waste levels.

2.4 Previous assessment of the LLC and Eco-Schools

The LLC aims to have at least 1,400 schools implement and improve a waste management system by 2022 (Eco-Schools, 2020). It also targets attitude and behavior learning outcomes and it aims for a 10-20% improvement by 2022. Each year FEE evaluates the LLC using student and teacher questionnaires, and analyses of litter collection at each school. All Eco-Schools must report one of the following litter measurements six times during the campaign: amount of litter found in the school yard, amount of litter and waste collected in the school, amount of paper collected in the school or classrooms, or the amount of waste recycled in the school or classrooms. Schools that were in lockdown due to COVID-19 had

students monitor specific types of waste in their home. In this case, the students reported their results to their teacher and the average change (in %) for each waste type was reported to the NO (FEE, 2020).

Previous assessments have been done on a yearly basis to illustrate the progress of the LLC to sponsors and as a result, emphasize the positive impact of the LLC. The guidelines for this annual impact assessment can be viewed in Appendix G. Eco-Schools that have not participated in the LLC (or similar campaigns) in recent years are used as reference for campaign evaluation and are referred to as "control schools". Control schools are invited to join the LLC in the following year. The LLC is evaluated at the end of the spring semester; Northern hemisphere schools are surveyed March to May while Southern hemisphere schools are surveyed November to January (FEE, 2020). Each year, data is collected from half of the countries that participate in the campaign. In each country, 30% of the schools implementing the campaign are sampled. The number of students sampled from each school is approximately 20 (FEE, 2020).

The LLC has not been previously studied but there is a large amount of research on the impacts and influences of the Eco-School programme on students. EL among students from Eco- and ordinary schools in Slovenia was studied by Krnel (2009). Eco-School students had slightly higher environmental knowledge, but their environmental attitude remained unchanged. Two studies of Eco-Schools in Flanders surveyed the effect of environmental knowledge, attitude, and behavior (Boeve-de Pauw and Van Petegem, 2011 and 2013). Both studies demonstrated that Eco-School students demonstrated an increase in environmental knowledge, but there was no influence on their attitudes or behaviour. Similar studies that have compared environmental knowledge, attitudes, and behavior of students from schools participating in ESE programmes to students from schools that did not participate in ESE programmes suggest that ESE programmes influence cognitive outcomes rather than attitude (Olsson et al., 2016; Boeve-de Pauw and Van Petegem,2017; Lace-Jeruma and Birzina, 2019; Olsson et al., 2019).

Chen and Tsai (2016) found that university students do not actively participate in environmental protection endeavors, especially when it requires financial or political involvement despite having a positive attitude towards the marine environment and possessing a moderate level of marine knowledge

Chaigneau and Daw (2015) assessed the effects of individuals and villages in the support of marine protected areas (MPA) using surveys. Attitudes were found to be weak predictors of actions compared to contextual factors. Klockner (2013) identified intentions, attitudes, perceived responsibility, and awareness of consequences as predictors of environmental behavior. They also noted that intervention strategies need to be combined to change behavior and that a single strategy will often fail (Klockner, 2013). Hartley (2018) assessed individuals' attitudes and behavioral intentions regarding marine litter across Europe to better understand public understanding about marine litter and accumulation. Individuals who experienced litter on the coast had higher concern and behavioral intentions. They also found that Europeans were more aware of the effects of marine litter on marine life than for wider impacts (Hartley, 2018). While education increases knowledge, it does not always result in behavior change (Andriamalala et. al, 2013) and the barriers which prevent positive attitudes from resulting in positive actions and contextual factors which can facilitate positive behavior need further study (Chaigneau and Daw, 2015).

2.5 Theory of Change

To evaluate the effects of a programme, the Theory of change is often used. Connell and Kubisch (1998) define the Theory of Change as "a systematic and cumulative study of the links between activities, outcomes, and contexts of the initiative" (pg. 2). The Theory of Change is a model which maps a pathway for the desired behavior change (Connell and Kubisch, 1998). Each step of the Theory of Change can be assessed by an indicator metric, and each stage moves toward the behavior change objective. Indicators may include questionnaire responses and quantitative information such as the percentage of the population recycling or the reduction in purchases of single use plastic (Ashley, Pahl, Glegg, & Fletcher, 2019). Each stage relates to a predictor of behavior change as each stage moves from knowledge of the issue to changes in attitude and the intention to act to address the issue. These stages have been identified in behavioral science by Klöckner (2013) and Pahl and Wyles (2017). These stages are also identified in the environmental literacy ladder (ELL) and can be seen in Figure 2.3 (ELL, 2007). The ELL outlines five main steps in achieving environmental literacy and each one builds on the previous step.

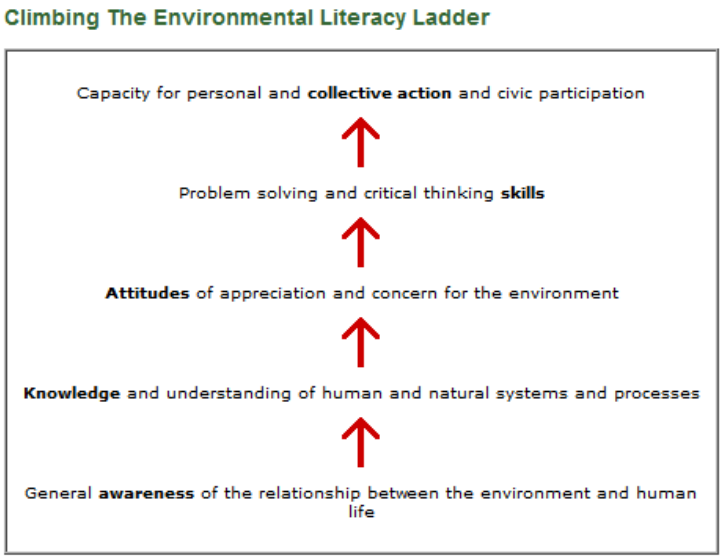

Figure 2.3. *Stages of the environmental literacy ladder (ELL, 2007).*

There are many examples of the Theory of change being used in ESE; Ashley et al. (2019) evaluated the effectiveness of two education programs: courses focused on sustainable seafaring in the shipping industry at a technical college and ocean literacy films shown at an aquarium in the UK. Using the Theory of Change, changes in attitude and intention were identified (Ashley, 2019); pre and post surveys were used to assess if the programme's objectives had been achieved. Environmental awareness significantly increased between pre and post surveys and while knowledge, attitude and intended indicator objectives were met, effectiveness may have been limited by the small sample size. The Theory of Change was also used by Saypanya et al. (2013) and Andriamalala et al. (2013) to assess behavior change regarding wildlife conservation initiatives.

The use of behavior change predictors as indicators has shown to be useful for monitoring objective achievement in EL, but the assessment would be improved with follow-up surveys to record behavior change in the following months after the intervention (Ashley et al., 2019). Objective indicator data, such as observational data, is also needed to assess long-term behavior change (Ashley et al., 2019). Surveys and questionnaires are useful tools for better understanding people's perceptions and decision-making, but they do not provide a complete picture; humans are prone to inaccurate self-reporting to

achieve or maintain an ideal self-image (Brenner & DeLamater, 2016). Additionally, surveys are not representative of an entire population as noted by Fauville et al. (2019); their samples were not representative of the countries where they took place so their conclusions could not be applied to the entire country. Evaluation of environmental literacy programs have focused on assessing knowledge and awareness, but sustainable behavior adoption and behavior change have not been measured (Ashley et al., 2019). Ashley et al. (2019) points out that such evaluation is required to see whether increases in awareness and knowledge described in surveys change behavior and decision-making after an intervention.

Using the Theory of Change, a logic model has been created for the LLC and it is shown in Figure 2.4. The model illustrates the connections between the inputs, activities, participants, and intended outcomes of the programme. The main focus of this research is to examine whether LLC students' knowledge of waste and attitude toward waste have increased which is a short-term outcome of the LLC.

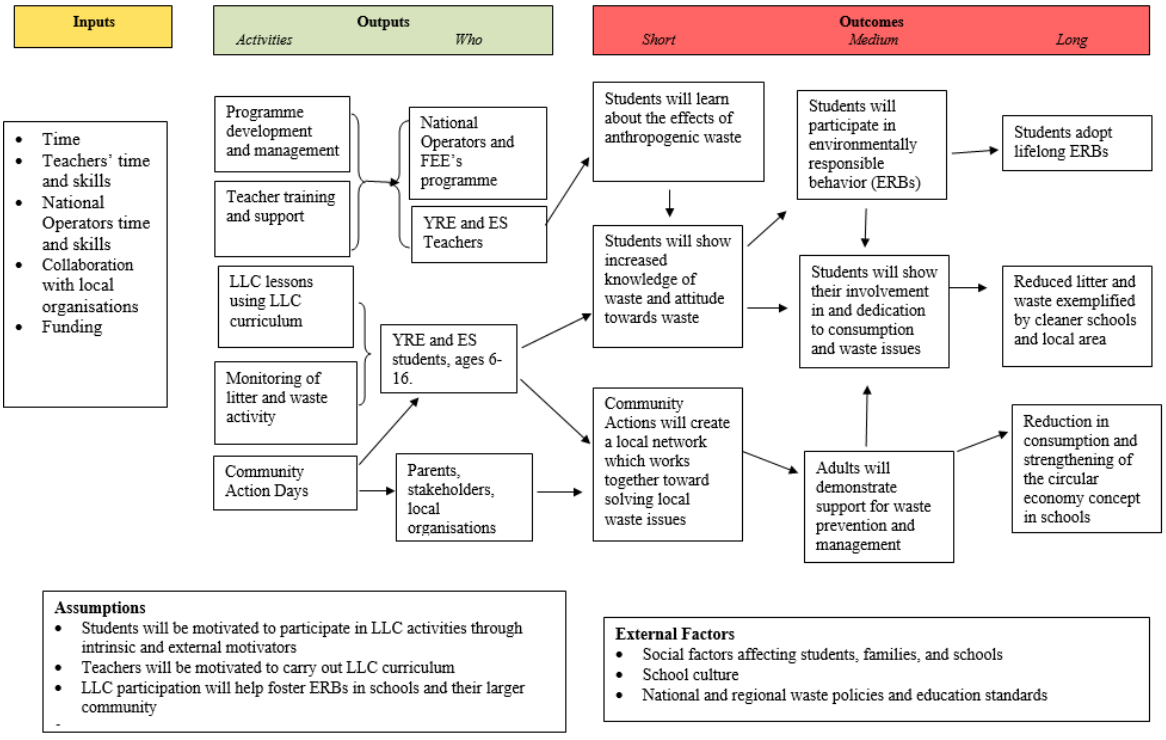

Figure 2.4. *A logic model developed for the LLC.*

3. Methods

A mixed methods approach was used to analyse the LLC and its effects on waste literacy in Ireland, Northern Ireland, and Russia. First a literature review was performed. Three forms of data were then analysed: student questionnaires, teacher questionnaires, and interviews with national operators. The three countries were chosen based on data availability.

3.1 Student questionnaire

Participants and data collection. Schools from fourteen countries participated in the LLC and were surveyed annually. Each country had a group of students from control schools which did not participate in the LLC and another group of students from schools which participated in the LLC that school year. All LLC participants were either students from the Eco-Schools or YRE programme. Each YRE and ES group had a matching control group. Each country received a tailored questionnaire. Participants were given an anonymous electronic or written questionnaire asking them about age, gender, school, their attitudes toward litter, their attitudes toward litter prevention, and their knowledge about waste. The questionnaire was collected in March to May of 2021. The time it took to complete the student survey ranged from ten to twenty minutes.

Instrument. An annual questionnaire (Appendix B) was adapted for each country to evaluate the impact of the LLC by assessing the waste knowledge and attitudes of LLC students and non-LLC students. The questionnaire included three sections: sociodemographic information, environmental attitude, and waste knowledge. The first section of the questionnaire consisted of four or five questions which collected demographic information. This included school name, gender, and age. The frequency rates for each of these factors, except postal code, were calculated. Each year the LLC questionnaire was updated for the chosen learning goals of each country. The questionnaire also differed for the ES and YRE programmes.

The questions were based on the intended learning outcomes of the LLC. Each country's questionnaire was translated by FEE into the native language and had a total of 12 to 18 questions.

In 2021, questions 1, 5, and 6 used a Likert scale (1 = *not important* to 5 = *very important*). Question 2 asked students to rank items in order (1 = *least important/effective*, 5 = *most important/effective*). Question 3 used a semantic differential scale (1 = *never heard of it*, 2 = *I have heard of it but can't explain* it, 3 = *I can explain it*). Question 4 was nominal and asked participants to select items that were recyclable (binary, 1 = *no*, 2 = *yes*). The different versions of each question are shown in table 3.1. In total, nine questions were analysed, including demographic information.

No.	Question	Question type	Answer choices	Category
1	How important do you think it is that people reduce the amount of waste they produce at home?	Semantic differential scale	5 = Very important , 1 = Not important	Attitude
2	There are different ways to reduce the harmful effects of waste on the environment. How would you rank their importance/effectiveness?	Rank items in order.	5 = Most effective, 1 = Least effective	Knowledge
3	Below is a list of topics: 1) Recycling 2) Composting 3) Incineration 4) Landfill 5) Waste sorting 6) Decomposition and 7) Sustainability. Please mark how much you know about them.	Single select	1 = Never heard of it, 2 = I have heard of it, but I cannot explain it, 3 = I can explain it	Knowledge
4	A list of materials and items is provided below: 1) Glass 2) Plastic 3) Tins and cans 4) Clothes 5) Paper 6) Garden waste and 7) Mobile phones. Please tick the boxes next to the ones that can be recycled.	Multiple response	Tick all that apply.	Knowledge
5	How often do you: (1) Feel bothered by litter you see lying around, (2)Keep a food wrapper with you until you find a waste bin, (3) Talk to your family about waste, (4) Use both sides of paper for writing or drawing, (5) Sort waste into different bins, (6) Re-use things instead of buying new.	Semantic differential scale	1= Never, Rarely, Sometimes, Often, 5 = Very often	Attitude
6	If you saw your friend throwing a food wrapper in the school yard, what would you do?	Semantic differential scale	5 = Very likely, 1 = Very unlikely	Attitude

Table 3.1 *Questions chosen for analysis.*

Data cleaning and coding. A new dataset was created from the dataset provided by FEE. The dataset was limited to the variables of interest. Variables were re-coded to allow analysis and the syntax can be viewed in Appendix C. The dataset was checked for duplicate entries, spelling mistakes, non-valid labels

and impossible or unexpected values for each of the variables. Missing values were checked for and none were found.

Data reduction and reliability testing. Questionnaire response data was prepared in Excel and re-coded in SPSS for Categorical principal component analysis (CATPCA) and scoring. Data sets consisting of many variables with complicated correlation patterns can be reduced to a smaller number of uncorrelated summary variables (principal components) that represent the information in the data as closely as possible (Linting et al., 2007). CATPCA is suitable for variables with nominal, ordinal, and numeric measurement levels. They also do not have to be linearly related to each other (Linting et al., 2007; Linting and Van der Kooij, 2012). When all variables in a data set are considered numeric and relationships are linear, CATPCA and PCA will produce the same results. If the analysis includes variables specified as having a nominal or ordinal analysis level, CATPCA will deal with nonlinear relationships (Linting and Van der Kooij, 2012). The CATPCA method outlined by Linting and van der Kooij (2012) was used on the LLC student questionnaire to simplify the analysis of the knowledge and attitude variables.

Questionnaire scoring. Based on the CATPCA results separate attitude and knowledge scores could be created. A quantizing method was used to score questionnaire responses (Srnka & Koeszgi, 2007). Each correct answer item was given a score of 1 in knowledge questions. Knowledge scores were then converted to a percentage for comparison and analysis. Attitude was assessed using three semantic differential scale questions. Each item had 5 possible points. Attitude scores were also converted to percentages for analysis. The supporting code is available in Appendix C.

Waste attitude and knowledge analysis. SPSS was used first used for descriptive statistics and cross-tabulating, and additional data analysis as follows:

(1) Normality was tested for each group using histograms and the Shapiro-Wilk test.

(2) The Wilcoxon-Mann-Whitney test examined differences in waste literacy variables between students in the LLC and non-LLC students. Cliff's delta was then calculated for comparison to

determine the effect size. The data set was then split by country and the same analysis was run in each country.

(3) Multiple analysis of variance (MANOVA) was used to determine the effect of background variables on knowledge and attitude scores (Figure 3.1). As the knowledge and attitude scores are continuous variables and the independent variables consist of two or more categorical groups, a MANOVA analysis is recommended (Lund Research, 2018; Finch, 2016). One of the advantages of using MANOVA, as opposed to making a multiple ANOVA, is that it may better portray real world relationships (Finch, 2016; Stevens, 2001). A treatment will affect participants in more than one way and the inclusion of more than one dependent variable will yield a more holistic picture (Stevens, 2001). If a statistically significant interaction effect is found, this indicates that the effect of the LLC on attitude and knowledge depends on students' gender, nationality, and age.

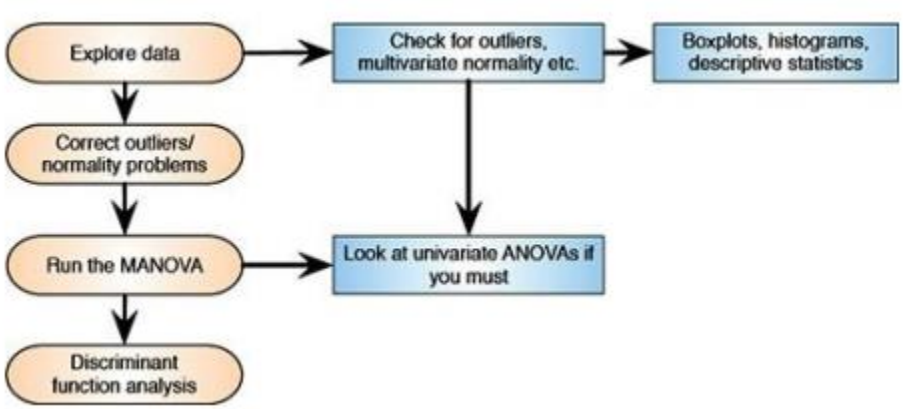

Figure 3.1. *The MANOVA process (Field, 2009).*

3.2 Teacher questionnaires

Teacher questionnaires were first analysed using descriptive statistics and cross-tabulating. Braun and Clarke's (2006) steps for thematic analysis were then used to analyse free responses of teacher questionnaires: (1) gaining familiarity with the data; (2) generating initial codes or labels; (3) searching

for themes or main ideas; (4) reviewing themes or main ideas; and (5) defining and naming themes or main ideas. First, participant responses to the open-ended questions were read and re-read to understand and the data. Next, data that were meaningful to the study were noted, recurring messages were identified, and codes generated in the form of phrases to represent significant data. For this study, the coding was implemented using Excel and code were modified through the process. The codes chosen aimed to identify the elements that the teachers and NOs noted as important to them in their responses (Ilse Benavides-Lahnstein & Ryder, 2020). Common or repetitive codes were used to determine themes. Braun & Clarke (2006) point out that there no strict rules about what makes a theme except its significance. They also mention there may be overlap between the codes and themes in a small dataset (Braun & Clarke, 2006).

3.3 National Operator Interviews

Semi-structured interviews were conducted with the NOs of Ireland and Russia. The NO of Northern Ireland could not be interviewed. Semi-structured interviews are useful in understanding opinions and getting information from a particular group of people (Mweti & Van Wyk, 2005). They also offer rich and extensive data compared to surveys or open-ended survey responses as open-ended questions allow interviewees to provide in depth answers, which can be probed further (Yin, 2012). Interviews with NOs focused on programme implementation, teacher training, curriculum, programme results, recommendations for improvement, and programme strengths. Interview responses were also analysed using Braun and Clarkes' (2006) thematic analysis approach; interview transcripts were first loaded into Excel and then coding was performed manually.

4. Student questionnaire analysis and results

This chapter presents the statistical test results of student responses which were found using SPSS. First, the results of categorical principal component analysis (CATPCA) are presented followed by the analysis of attitude and knowledge scores. First, demographic data and response frequencies are presented. Lastly, the effects of nationality, gender, and age are analysed.

4.1 Categorical principal component analysis

When attempting to measure intangible concepts, such as motivation, satisfaction, or attitude, it is commonly recommended to group several Likert-type items, then calculate a total score or mean score for the scale items. It is then suggested to use the Cronbach alpha or factor analysis technique to provide evidence that the components of the scale are sufficiently intercorrelated and that the grouped items measure the underlying variable (Field, 2009; Linting & van der Kooij, 2012). The following section analyses questions from the LLC questionnaire for intercorrelations between variables to determine whether variables can be grouped together. This analysis was run multiple times to find the best fitting model. Results of the other runs can be found in Appendix F.

FEE intended to measure two dimensions with the student questionnaire – waste knowledge and waste attitude. To validate the assumption that the selected items for waste knowledge and attitude were representing these constructs, categorical principal component analyses (CATPCA) was performed in SPSS. Questions 1, 5, and 6 were intended to assess waste attitudes and question 2, 3, and 4 were meant to assess waste knowledge. A sample of about 300 respondents is considered a good sample size for principal component analysis, thus the sample exceeds this requirement (Field, 2018).

4.1.1 Attitude component

Questions 1, 5, and 6 were intended to assess waste attitudes and each of these questions used a Likert-type scale. Missing options were not relevant as the LLC data do not contain missing values and

the discretizing option *Ranking* was selected to analyse the attitude component of the student questionnaire.

Analysis level. The variables were set to different analysis levels, as recommended in the literature and transformation plots were used to determine the ideal analysis level. Figure 4.1 shows the transformation for selected attitude items at ordinal and nominal scaling levels. The rest of the transformation plots can be found in Appendix D and E.

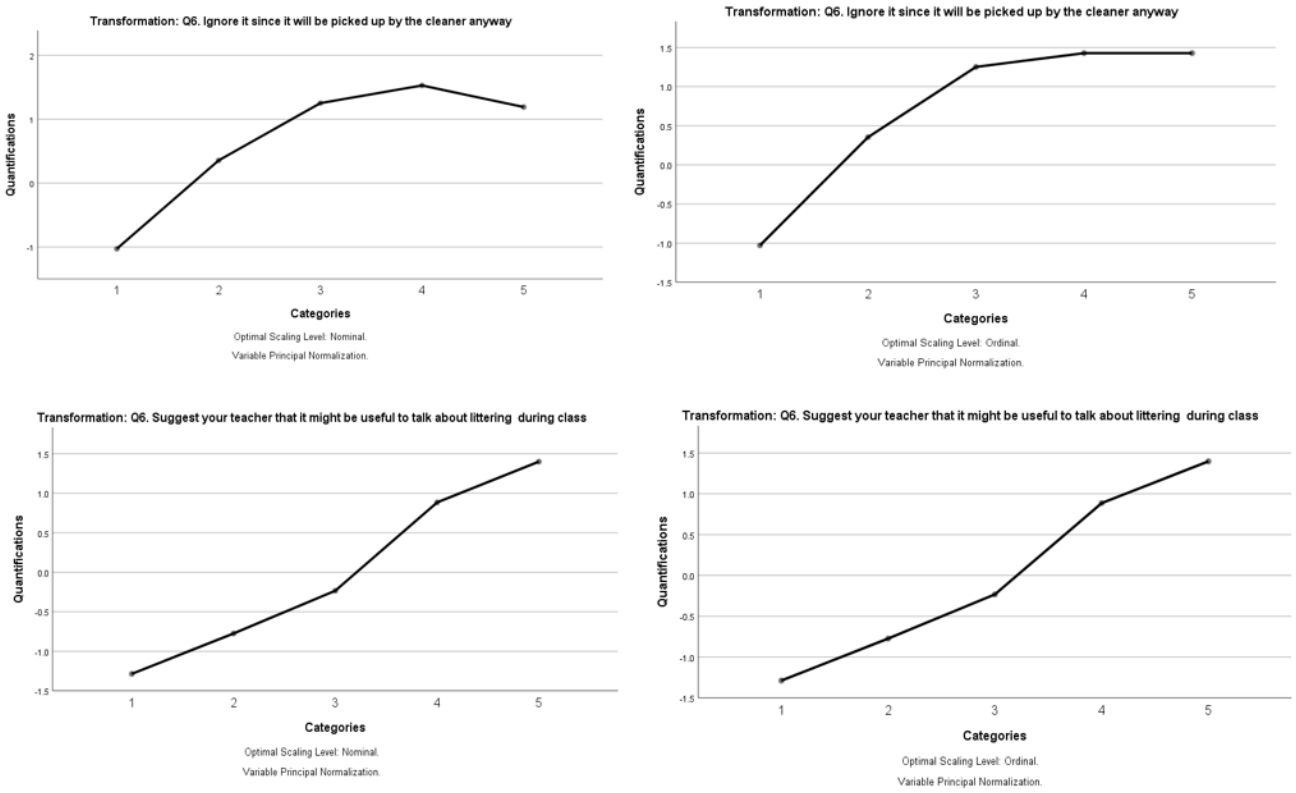

Figure 4.1. *Transformation plots of select attitude variables at two levels: nominal on the left and ordinal on the right.*

When an ordinal analysis level was applied to *Q6. Ignore it*, the transformation plot showed a plateau for some categories with low frequencies. However, when running CATPCA with the least restrictions, at the nominal level, the categories in the plateau exhibited similar nominal quantifications. Since the variance accounted for (VAF) did not change significantly with different analysis levels the ordinal analysis level

was chosen to ensure more stable results for all variables (Linting & van der Kooij, 2012). The ordinal analysis level was also chosen because Q1, Q5, and Q6 produced ordinal data.

Outliers. Potential outliers were searched for using the objects plot (Figure 5.2.2) and the objects scores. Component scores are standard scores, and scores exceeding the range of –3.5 through 3.5 can be considered outliers and the most insightful way to detect outliers is by looking at plots of the component scores (Linting & van der Kooij, 2012). The same outlier was found at both nominal and ordinal levels using the object plot and object scores: case 77. This outlier was removed from the analysis and the analysis was run again to check for new occurring outliers. No outliers exceeded the range of –3.5 through 3.5.

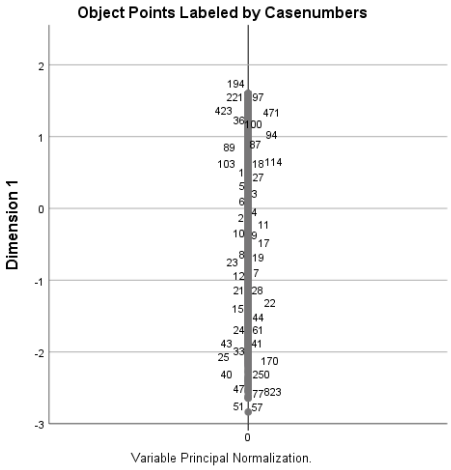

Figure 4.2. *Object plot at the spline nominal analysis level*.

Dimensions. In CATPCA, because of the optimal scaling which it applies, the eigenvalues of the first p principal components (where p is the number of components as specified by the user) are maximized. In other words, the nonlinear PCA solutions are “not nested” for different numbers of components, and the scree plots differ for different specified dimensions. Hence, an elbow can be shown after the first p components in nonlinear PCA. For this reason, when the elbow is consistently at p or p+1 components,

the solution of p components can be chosen (Linting et al., 2007; Linting & van der Kooij, 2012). When choosing the number of components, the scree plots from different specified dimensions should be considered. Additionally, interpretability is an important criterion when choosing the number of components (Linting et al., 2007; Linting & van der Kooij, 2012). Scree plots and eigenvalues for one-, two- and three-dimensional solutions for the quantified variables were compared and, consistently, all the scree plots showed an elbow after the first component (Figure 5.2.3). Based on the scree plots, the one-dimensional attitude solution was confirmed. However, based on the eigenvalue criterium the two-dimensional solution revealed an eigenvalue of greater than 1 (i.e., 1.039) for the second component, thus the two-dimension solution was also analysed (Linting et al., 2007).

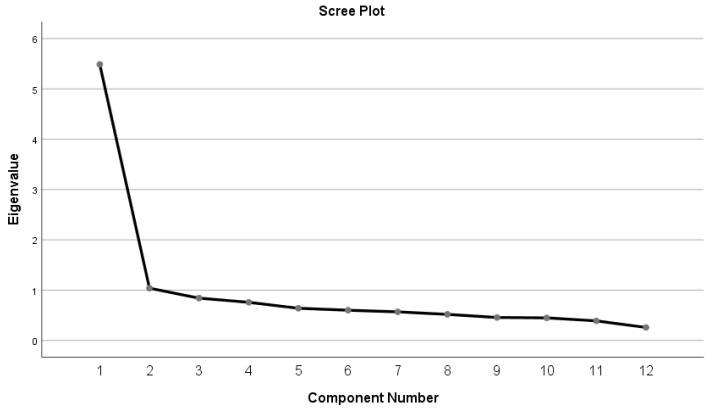

Figure 4.3. *Scree plot result for one-, two-, and three-dimensional solutions*.

Variable selection. For variable selection, communalities of the quantified variables were analysed. These communalities are shown in the Variance Accounted For (VAF) table in SPSS and can be seen in Table 4.1. Based on the rule of thumb for VAF in a variable per component, 10% is poor, 20% is fair, 30% is good, 40% is very good, and 50% is excellent (Linting & van der Kooij, 2012). The one-dimensional solution yielded a total eigenvalue (VAF) of 5.72, which reflected 46% of the variance in the transformed variables. Thus, the solution indicated a very good fit. For variable selection the total VAF of each variable is used. Variables with total VAF of .25 or higher are selected for the final analysis. This means

at least 25% of the variance in a quantified variable is explained across the principal components. Total VAF of two- dimension solution was 54.85% and yielded a total eigenvalue (VAF) of 6.58.

Variable	Dimension 1
Q6. Tell him it is not ok to litter	0.615
Q6. Ask them to pick it up and throw it into a waste bin	0.586
Q5. Feel bothered by litter you see lying around	0.552
Q5. Talk to friends and family about waste	0.510
Q6. Pick it up yourself and throw it into a waste bin	0.505
Q5. Keep a food wrapper with you until you find a waste bin	0.456
Q5. Re-use things instead of buying new	0.438
Q6. Suggest your teacher to talk about littering during class	0.437
Q5. Sort waste into different bins	0.431
Q5. Use both sides of paper for writing or drawing	0.427
Q1.Importance of reducing the amount of waste they produce at home	0.374
Q6. Ignore it since it will be picked up by the cleaner anyway	0.241

Table 4.1. *Total VAF of each variable in dimension 1 at the ordinal analysis level.*

The variable Q6. *Tell them it is not ok to litter* had the highest VAF of 0.615. This shows that 61.5% of its variance was explained by the principal component. Variable Q6. *Ignore it* had the lowest VAF in dimension 1 (24.1%) and was removed from the analysis. The remaining variables' VAF were greater than 37%. All variables fitted from good to excellent were kept in the CATPCA. After *Q6. Ignore it* was removed the total VAF increased from 46.42% to 48.78%, and all other variables were kept for the remaining analysis. The removal of Q6. *Ignore it* also eliminated the need for the two-dimension solution as it lowered the eigenvalue of dimension 2, confirming a one-dimensional solution. In the two-dimensional solution, the 12 variables yielded a total VAF of 54.85% and all the variables except *Q6. Ignore it* had a VAF less than 0.3 showing that it was the only variable contributing to the VAF of dimension 2, further confirming a one-dimensional solution (Table 5.2.2).

	Dimension 1	Dimension 2
Q6. Tell them it is not ok to litter	0.615	0.058
Q6. Ask them to pick it up and throw it into a waste bin	0.587	0.073
Q5. Feel bothered by litter you see lying around	0.555	0.026
Q6. Pick it up yourself and throw it into a waste bin	0.506	0.011
Q5. How often do you talk to friends and family about waste?	0.507	0.133
Q5. Keep a food wrapper with you until you find a waste bin	0.456	0.124
Q6. Suggest your teacher to talk about littering during class	0.436	0.145
Q5. Re-use things instead of buying new	0.437	0.073
Q5. Sort waste into different bins	0.431	0.141
Q5. Use both sides of paper for writing or drawing	0.428	0.006
Q1.Importance of reducing the amount of waste they produce at home	0.374	0.013
Q6. Ignore it since it will be picked up by the cleaner anyway	0.233	0.332

Table 4.2. *VAF of the two-dimension solution.*

Component loadings. Component loadings indicate Pearson correlations between the component and the quantified variables and range between -1 and 1 (Linting et al., 2007). The component loadings of each of the analysis variables are presented in Table 4.3 and all had a loading greater than 0.6. As a rule of thumb in factor analysis, a variable is associated with a factor if its loading exceeds 0.3 (Everson et al., 2014; Field, 2018). Figure 4.4 depicts the loading vectors for each variable; a loading vector starts at the origin (the mean of the quantified variable) and ends at the loading point and represents a variable's VAF (Linting & van der Kooij, 2012). From these results, it was concluded that the variables listed in Table 4.3 assessed the same component – attitude towards waste.

	Dimension 1
Q6. Tell them it is not ok to litter	0.784
Q6. Ask them to pick it up and throw it into a waste bin	0.762
Q5. Feel bothered by litter you see lying around	0.749
Q5. Talk to friends and family about waste	0.720
Q6. Pick it up yourself and throw it into a waste bin	0.715
Q5. Keep a food wrapper with you until you find a waste bin	0.669
Q6. Suggest your teacher to talk about littering during class	0.668
Q5. Re-use things instead of buying new	0.666
Q5. Sort waste into different bins	0.660
Q5. Use both sides of paper for writing or drawing	0.653
Q1.Importance of reducing the amount of waste produced at home	0.616

Table 4.3. *Component loadings of attitude variables.*

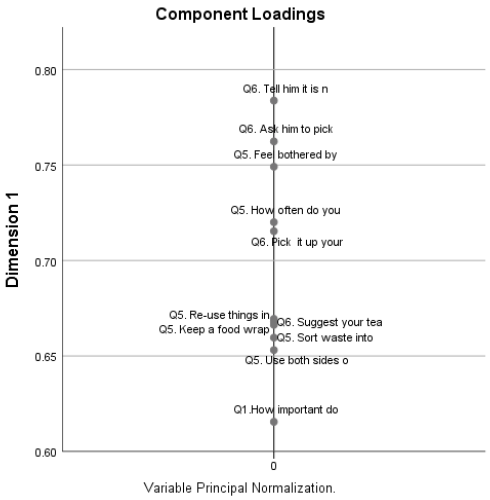

Figure 4.4. *Plot of component loadings.*

4.1.2 Knowledge component

Question 2, 3, and 4 intended to assess waste knowledge questions. Question 2 and 4 produced nominal data, while question 3 produced ordinal data. CATPAC was used to test whether these indicators could be identified as representing the knowledge dimension. Prior to the CATPCA and the reliability analysis, question 2, 3, and 4 were recoded so that no zeroes were possible.

Analysis level. Transformation plots for all variables were similar at the nominal and ordinal analysis level (Appendix E). A nominal level was selected for variables Q2 Total score and Q4 Total score, and an ordinal level was selected for all Q3 variables. No outliers were identified.

Dimensions. The variables were quantified using the vector model and specified different dimensions to check if the one-dimensional assumption held. The generated scree plots for one-, two- and three-dimensional solutions were identical and, consistently, showed an elbow on the second and third components (Figure 4.3). The one-dimensional solution had a total VAF of 36.5% while the two-dimensional solution yielded a total VAF of 54.79% at both nominal and ordinal analysis levels. Using the scree plots and VAF, a two-dimensional solution was confirmed.

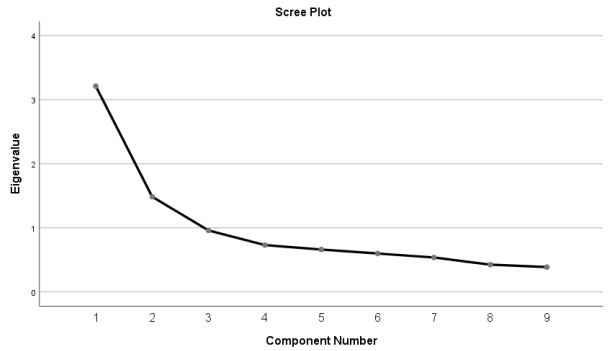

Figure 4.5. *Scree plot for one-, two-, and three-dimensional solutions.*

Variable selection. In the first dimension, all of the variables had a total VAF greater than 0.3. However, five variables also had high VAF in dimension 2 (Table 4.4). Additionally, the solution was not straightforward in terms of the interpretability (Linting et al., 2007). All variables were kept for the analysis of component loadings.

	Dimension 1	Dimension 2	Mean
Q3. Decomposition	0.553	0.015	0.284
Q3. Waste sorting	0.499	0.001	0.250
Q3. Sustainability	0.499	0.098	0.299
Q3. Composting	0.402	0.220	0.311
Q4 Total score	0.360	0.140	0.250
Q2 Total score	0.072	0.046	0.059
Q3. Incineration	0.250	0.526	0.388
Q3. Landfill	0.282	0.440	0.361
Active Total	2.918	1.487	2.203
% of Variance	36.471	18.592	27.531

Table 4.4. *VAF of all knowledge variables in two dimensions*.

Component loadings. In Figure 4.5, the unrotated component loadings plot shows the loading vectors of the transformed variables. The loading vectors run from the origin to the loading points which is signified by the grey points in the plot. Their length reflects the variable VAF, and the angle between the vectors indicates the correlation between the variables. Variables that make wider angles, signify that the variables are unrelated. In contrast, the small angle indicates that the variables are strongly and positively related (Linting et al., 2007; Linting & van der Kooij, 2012).

	Dimension 1	Dimension 2
Q3. Decomposition	0.744	0.101
Q3. Waste sorting	0.707	0.009
Q3. Sustainability	0.706	-0.309
Q3. Composting	0.634	-0.469
Q4 Total score	0.599	-0.373
Q2 Total score	0.264	-0.206
Q3. Incineration	0.497	0.724
Q3. Landfill	0.531	0.663

Table 4.5. *Component loadings in two dimensions, unrotated*.

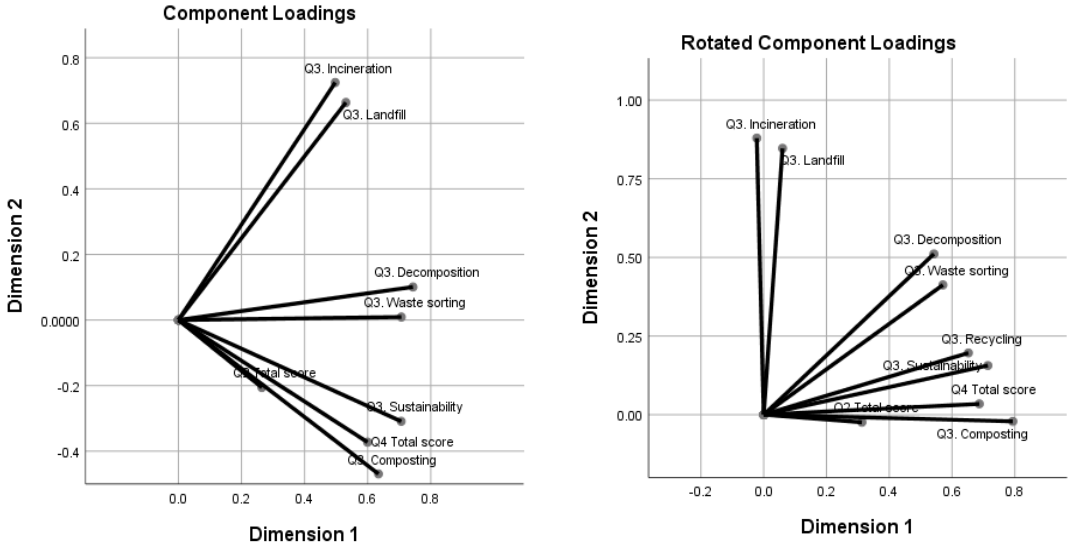

Figure 4.6. *Component loading plot of Q2, Q3, and Q4 variables at the nominal analysis level, unrotated on the left and varimax rotation on the right.*

The solution presented here is unrotated. Rotation is a method for simplifying the structure by maximizing the loadings on only one of the two components (Field, 2018; Linting et al., 2007). Based on the component loadings plot, most of the Q3 variables had a weak correlation with Q2 and Q4. The analysis was run again with varimax rotation, but the results were similar (Table 4.6). Upon closer analysis, question 3 assessed the person's perception of their own knowledge rather than actual knowledge. A factor with four or more loadings greater than 0.6 "is reliable regardless of sample size." (Field, 2018). For this reason, and because of high cross-loadings of multiple variables, Q3 items were

removed from the CATPCA of the knowledge component. To achieve a simple structure and interpretability of the results Q2 and Q4 were analysed again separately for the knowledge component.

	Dimension 1	Dimension 2
Q3. Composting	0.793	-0.021
Q3. Sustainability	0.714	0.156
Q4 Total score	0.687	0.034
Q3. Recycling	0.652	0.196
Q3. Waste sorting	0.571	0.413
Q3. Decomposition	0.542	0.511
Q2 Total score	0.313	-0.024
Q3. Incineration	-0.022	0.879
Q3. Landfill	0.060	0.847

Table 4.6. *Component loadings of knowledge items with varimax rotation.*

When CATPCA was run on the total scores of Q2 and Q4, nominal and ordinal analysis levels had similar results and the one-dimension solution was confirmed and yielded a total VAF of 60.17%. A nominal analysis level was chosen because both questions had dichotomous response options. Each variable had a VAF of 0.60 and high component loadings. Since both variables loaded highly (over 0.75), there was no need for rotation. Interpretation was feasible without rotating the variables.

4.2 Internal consistency

The one-dimensional CATPCA solution for waste attitude yielded a high internal consistency coefficient, Cronbach's α=0.895. This value is above the threshold of 0.7, which is commonly used to indicate internal consistency (Everson et al., 2014; Field, 2018). The internal consistency was low for waste knowledge (α=0.338). It should be noted that the value of Cronbach's α depends on the number of the items. A large number of variables increases Cronbach's α (Field, 2018; Hof, 2012, p. 9). Additionally, the accuracy of the coefficient decreases with smaller number of response options (Gadermann, Guhn, & Zumbo, 2012). It is likely that Cronbach's α for the knowledge variables was low due to the small number of variables and the small number of response options caused by the dichotomous format of Q2 and Q4. According to Schwartz (n.d.), even coefficients with a value of 0.4 could be reasonable in cases of few items which are not very similar to one another.

4.3 Descriptive statistics

4.3.1 Demographic results.

The 2021 student sample had 1947 participants in total from Ireland, Northern Ireland, and Russia. In the Control group, Russia accounted for 79.9%, followed by Ireland (12.1%), and Northern Ireland (8%). Distribution was similar in the LLC group with Russia making up 77.2%, followed by Ireland (15.2%), and Northern Ireland (7.7%). When comparing YRE and ES programme responses, the majority came from Eco-schools. ES accounted for 92.3% and 92% in the Control and the LLC, respectively. Age, gender, and school name were collected. Age ranged from nine to sixteen in the Control and nine to eighteen in the LLC. The average age of participants was 11.7 in the Control group and 11.8 in the LLC groups. The findings revealed that the LLC group was 47.6% male and 52.4% female. In the Control, 49.76% were male and 50.3% female.

4.3.2 Response Frequencies

Question 1. Question 1 was an attitude question which asked students to score, on a 5-level Likert-like scale, how important they think it is that people reduce their household waste production (Figure 4.7). 56.4% of the control and 80.1% of the LLC thought it was very important. 2.4% of the control and 0.2% of the LLC thought it was not important.

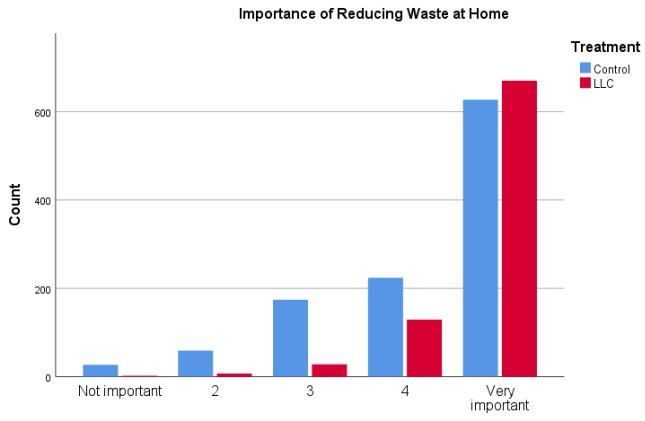

Figure 4.7. *Frequency of response to question 1 in 2021.*

Question 2. Question 2 was a knowledge question which asked students to rank the waste management strategies listed in the EU's Waste Hierarchy according to importance for impact (Figure 4.1.2). According to the EU, the strategies should be in the following decreasing order: prevention, re-use, recycling and composting, recovery, disposal in landfill (European Commission, n.d.). Each student received the list of strategies in a random order. Responses to this question are shown in detail in Table 4.7.

	Stop buying things		Re-using instead of discarding		Recycling and composting		Landfill		Burning for energy	
	Control	LLC	Control	LLC	Control	LLC	Control	LLC	Control	LLC
1 (Least effective)	20.8	16.5	13.6	6.9	10.3	4.8	32.1	51.1	22.7	20.7
2	19.4	22.0	19.8	13.6	13.3	7.2	17.3	21.3	23.9	35.9
3	23.9	26.0	20.3	23.7	19.0	18.1	16.1	13.0	18.2	19.3
4	20.5	19.5	24.2	34.7	20.4	22.4	17.5	9.2	17.9	14.2
5 (Most effective)	15.5	16.0	22.1	21.1	37.0	47.6	17.0	5.4	17.4	9.9

Table 4.7. *Response frequencies (in percentage) to question 2 items in 2021.*

Few students answered this question correctly in both samples as seen in Figure 4.8 (less than 5% of students in each). Fewer LLC students got this question entirely wrong compared to non-LLC students. *Recycling and composting* was ranked most as the most effective strategies in both samples. *Re-using* was the next most highly ranked. More than half of LLC students ranked *Landfill* correctly while 32% of non-LLC students also ranked it correctly. This question illustrates that LLC students do not understand the importance of reducing consumption; from the ranking it seems that recycling and composting has the greatest emphasis in the LLC.

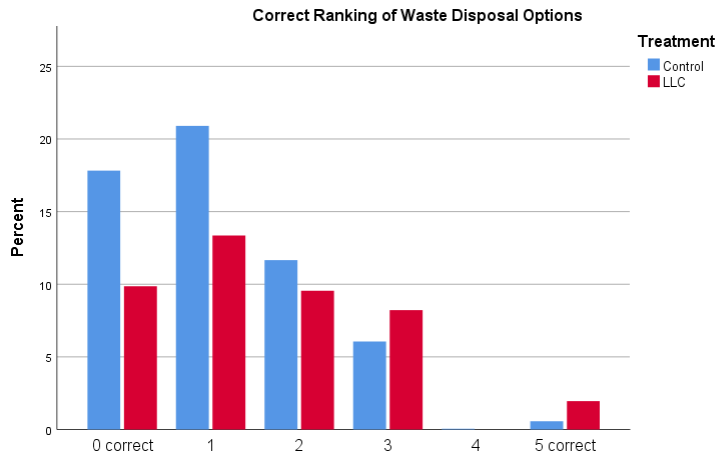

Figure 4.8. *Frequency of question 2 scores in 2021*.

Question 3. Question 3 asked students to indicate their level of knowledge of waste management terms using the options "Never heard of it", "I've heard of it, but I can't explain it" and "I can explain it". More LLC students could explain all items compared to non-LLC students (Table 4.8 and Figure 4.9). The only item that most LLC students could not explain was sustainability. This question required students to estimate their own understanding and while it does not accurately measure hard knowledge it is a measure of students' confidence and perception of their own knowledge.

	Recycling		Composting		Incineration		Landfill		Waste sorting		Decomposition		Sustainability	
	Control	LLC	Control	LLC	Control	LLC	Control	LLC	Control	LLC	Control	LLC	Control	LLC
Never heard of it	6.7	1.4	24.9	5.1	13.9	9.6	7.9	3.2	17.6	4.1	21.1	8.3	54.3	19.7
I have heard of it but cannot explain it	28.8	12.7	41.4	29.3	20.8	17.5	18.1	16.9	32.6	17.2	39.2	34.6	29.4	42.9
I can explain it	64.5	85.9	33.7	65.6	65.3	73.0	74.0	79.9	49.9	78.7	39.7	57.2	16.3	37.3

Table 4.8. *Percent of responses to question 3 in 2021, according to treatment*.

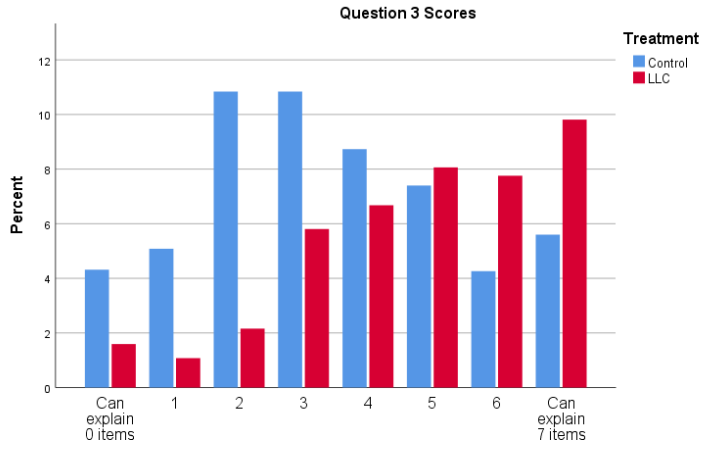

Figure 4.9. *Score frequencies for question 3*.

Question 4. Question 4 required students to mark which materials or items can be recycled. All the materials listed can be recycled. Most LLC students knew that glass, plastic, tins and cans, and paper can be recycled (Table 4.9) compared with 58-84% of the control group. However, only 37-62% indicated

that recycling of the clothes, garden waste, and mobile phones is possible. The percentages of control students marking these items as recyclable were consistently lower than those of LLC students (Figure 4.10). The way in which this question was asked likely influenced students' responses because it asked them if the material was recyclable where they lived, not if it was recyclable in relation to the material type or the processes involved.

Treatment		Glass	Plastic	Tins and cans	Clothes	Paper	Garden waste	Mobile phones
Control	Not recyclable	41.7	16.4	40.9	55.3	16.0	60.6	76.8
	Recyclable	58.3	83.6	59.1	44.7	84.0	39.4	23.2
LLC	Not recyclable	25.6	9.0	24.0	37.3	6.3	33.7	62.7
	Recyclable	74.4	91.0	76.0	62.7	93.7	66.3	37.3

Table 4.9. *Responses to question 4 in percentage*.

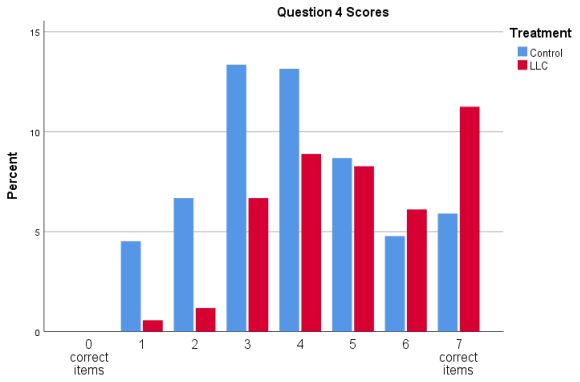

Figure 4.10. *Score frequencies for question 4*.

Question 5. Question 5 asked students to indicate their behaviour on a set of questions using a 5-level Likert scale ranging from "never" to "very often". LLC students' responses were consistently higher than the control in all the sub-questions (Tables 4.10) A small percentage of LLC students marked Never on the subitems (Figure 4.11). Fewer control students indicated that they perform positive waste behaviours.

	Feel bothered by litter		Keep a food wrapper with you until you find a waste bin		Talk to friends and family about waste		Use both sides of paper for writing or drawing		Sort waste		Re-use things instead of buying new	
	Control	LLC	Control	LLC	Control	LLC	Control	LLC	Control	LLC	Control	LLC
Never	8.0	2.2	4.7	0.6	23.2	7.3	8.7	2.0	23.3	8.3	14.6	3.0
Rarely	13.9	3.6	7.2	2.2	29.8	18.3	14.6	4.8	20.6	11.5	21.3	8.9
Sometimes	30.1	19.1	17.1	6.3	26.8	23.1	21.2	12.8	22.6	19.3	27.8	25.5
Often	27.4	37.6	28.8	33.0	11.3	33.5	26.4	34.2	16.9	35.3	19.8	42.1
Very often	20.7	37.6	42.2	57.9	8.8	17.8	29.1	46.2	16.6	25.7	16.5	20.6

Table 4.10. *Student responses to question 5 in percentage*.

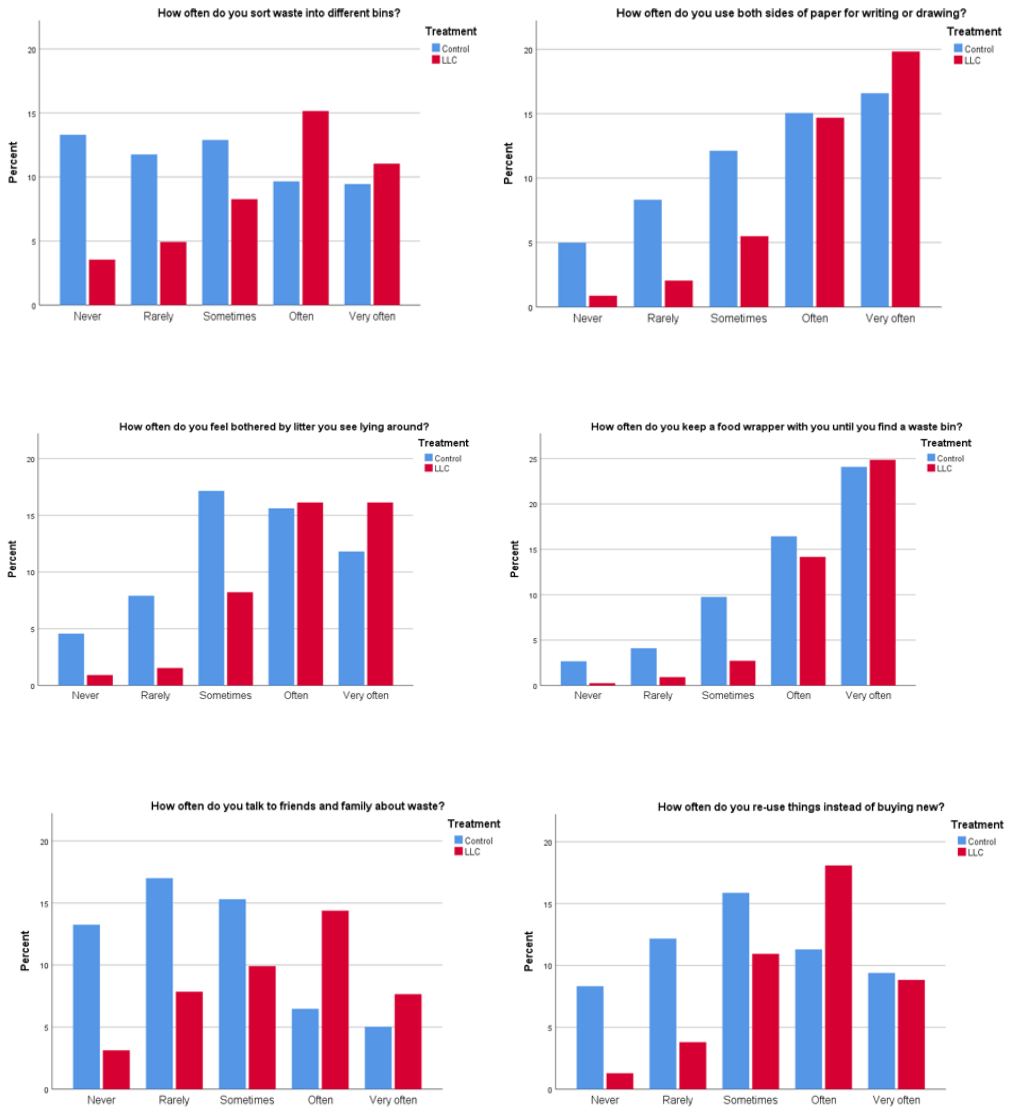

Figure 4.11. *Response frequencies for question 5, items 1 through 6*.

Question 6. Question 6 evaluated the students' response when they see a classmate littering in the school yard. A greater percentage of LLC students said they were very likely to take a positive action: 50% said they would tell them it's not ok, 43% said they would ask them to put it in the bin, 36% said they would

pick it up themselves, 26% said they would talk to the teacher to discuss litter in class, and less than 2% said they would ignore it (Table 4.11 and Figure 4.12. Answers suggest that LLC students are more likely to intervene when a litter incident occurs while non-LLC students are more likely to ignore it.

	Tell them it is not ok to litter		Ask them to put it in the bin		Pick it up yourself		Suggest your teacher that it might be useful to talk about littering during class		Ignore it	
	Control	LLC	Control	LLC	Control	LLC	Control	LLC	Control	LLC
1 (Very unlikely)	8.4	1.8	7.2	1.8	11.3	4.2	27.0	12.8	37.8	54.5
2	15.8	3.8	16.6	5.5	19.6	7.4	23.3	13.4	26.9	28.9
3	12.6	6.9	14.2	6.7	19.1	11.7	20.2	15.7	16.7	10.0
4	31.7	36.7	30.8	42.7	27.5	40.3	16.9	34.6	12.7	4.7
5 (Very likely)	31.6	50.7	31.2	43.3	22.5	36.4	12.6	23.6	5.9	1.8

Table 4.11. *Student responses to question 6 in percentage*.

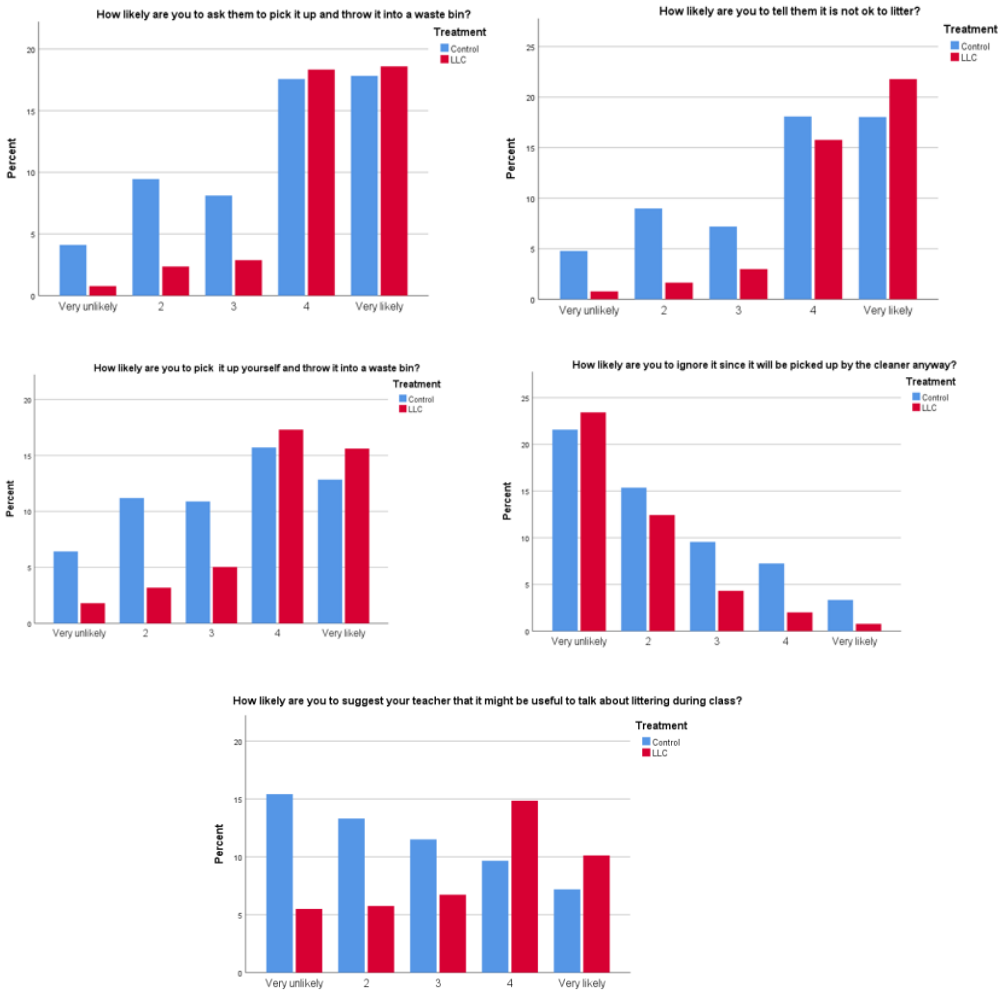

Figure 4.12. *Student score frequencies for question 6, items 1 through 5.*

4.4 Effect of the LLC on attitude and knowledge

This section analyses the effect of the LLC on waste literacy, specifically, waste attitudes and waste knowledge. Using the CATPCA results, the attitude and knowledge variables were scored to create an attitude score and knowledge score for each participant.

4.4.1 Statistic test selection

Because the attitude variables produced ordinal data, it is not recommended to use the means for comparison as the distance between categories is subjective (i.e. the average of *very important* and *somewhat important* does not exist) and the means of observations measured on an ordinal scale cannot be interpreted in the same sense as means based on ratio-scale variables. (Chen & Wang, 2014; Fernández, Liu, Costilla, & Yongqi Gu, 2020). While the knowledge variables produced nominal data, they were scored to create a new variable with continuous numerical data. To examine differences in a dependent variable (waste knowledge/attitude) measured at the ordinal or continuous level between two independent samples (LLC students and non-LLC students), a Wilcoxon-Mann-Whitney test is recommended. The Mann-Whitney U test is used to determine whether there are differences in the distributions of the two groups. However, if the two distributions are the same shape, the Mann-Whitney U test determines whether there are differences in the medians of the two groups (Lund Research, 2018).

Hypothesis testing relies on the statistical significance of the null hypothesis rejection and p-values decide the importance of the evidence, however, p-values do not really inform about the magnitude of a difference between two groups of observations (Macbeth, Razumiejczyk, & Ledesma, 2011). Effect size measures (ESMs) are a valuable tool for data analysis as they quantify the difference between two groups of observations beyond p-value interpretation. Nonparametric ESMs for two groups of observations depend on a dominance concept rather than the mean and the most direct and simple variety is known as Cliff's Delta (*d*) (Macbeth, Razumiejczyk, & Ledesma, 2011). *d* estimates the probability that a randomly selected observation from one group is larger than a randomly selected observation from the

other group, minus the reverse probability (Ledesma, Macbeth, & Kohan, 2009). An effect size of 1 or -1 indicates the absence of overlap between the two groups, whereas a 0.0 indicates the group distributions overlap completely (Ledesma, Macbeth, & Kohan, 2009). Cliff did not suggest corresponding values to represent small, medium, and large effects, however, interpretations have been made from Cohen's d: a difference in means that represents an effect size of 0.20 will have a delta value of 0.147, a d effect size of 0.50 corresponds to a delta value of 0.33, and a d effect size of 0.80 corresponds to a delta of 0.474. The absolute value of the Cliff´s Delta is considered small around 0.147, medium around 0.33, and large around 0.474 (Vargha & Delaney, 2000). The Cliff's Delta Calculator developed by Macbeth, Razumiejczyk, and Ledesma (2011) was used to measure the effect size in both the attitude and knowledge components.

4.4.2 Attitude

To compare the attitudes of LLC and non-LLC students, medians were compared, the Wilcoxon-Mann-Whitney test was performed, and Cliff's Delta was used. The following hypothesis was tested:

H_0: *The LLC has no effect on students' attitude towards waste.*

H_A: *LLC students are more concerned/aware of waste.*

As the data was ordinal, the most appropriate statistical test was Mann-Whitney U. Results are shown in Table 4.12. Descriptive statistics showed that LLC students (median = 0.82; mean rank = 1238.35) scored higher on waste attitude than non-LLC students (median = 0.67; mean rank = 775.08). The difference in attitude scores between the groups was found to be statistically significant ($U = 288013.5$, $Z = -14.498$, $p < 0.01$), and the difference between the control and LLC was large (cliffs delta = -0.485). Since the p-value is less than the chosen significance level ($\alpha = 0.05$), the null hypothesis can be rejected and there is evidence to suggest an association between the LLC and student scores in waste attitude in each year, and the effect size was large with larger values tending to be in the LLC sample (since the sign is negative).

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Cliff's Delta
Q1 total score	341216.5	958932.5	-12.014	0.000	-0.218
Q5 total score	249498.5	867214.5	-17.53	0.000	-0.438
Q6 total score	300548	918264	-13.393	0.000	-0.348
Total attitude score	243400.5	861116.5	-18.009	0.000	-0.485

Table 4.12. *Wilcoxon-Mann-Whitney test results for the attitude scores*.

4.4.3 Knowledge

The knowledge variables produced nominal data which were used to create a percentage for each student and the Wilcoxon-Mann-Whitney test could be used. The following hypothesis was tested:

H_0: *The LLC has no effect on student's knowledge of waste.*

H_A: *LLC students have increased knowledge of waste.*

If the p-value is less than the chosen significance level ($\alpha = 0.05$), the null hypothesis can be rejected and there is evidence to suggest an association between the LLC and knowledge scores. Cliff's delta was used to measure the size of the effect. As the data was continuous, the most appropriate statistical test was Mann-Whitney U. Descriptive statistics showed that LLC students (median = 0.5; mean rank = 1184.99) scored higher on waste knowledge than non-LLC students (median = 0.42; mean rank = 815.24). The Mann-Whitney was found to be statistically significant ($U = 288013.5$, $Z = -14.498$, $p < 0.01$), and the difference between the control and LLC was small (cliffs delta = -0.274) (Table 4.13). Since the p-value is less than the chosen significance level ($\alpha = 0.05$), the null hypothesis can be rejected and there is evidence to suggest an association between the LLC and student scores in waste knowledge in each year, however the effect size is small with larger values tending to be in the LLC sample (since the sign is negative).

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Cliff's Delta
Q2 total score	382590	1000306	-6.923	0.000	-0.121
Q4 total score	299229.5	916945.5	-13.662	0.000	-0.235
Total knowledge	288013.5	905729.5	-14.498	0.000	-0.274

Table 4.13. *Wilcoxon-Mann-Whitney test results for the knowledge scores*.

4.5 Effect of the LLC by country

To see whether the effect of the LLC was also significant in each country the knowledge and attitude scores were analysed again in each country. The data was split by country and the Wilcoxon-Mann-Whitney test and effect size was calculated.

4.5.1 Attitude

Descriptive statistics showed that Irish LLC students (median = 0.76; mean rank = 134.96) did not score significantly higher on waste attitude than non-LLC students (median = 0.76; mean rank = 127.25). The difference in attitude scores between the groups was not statistically significant (U = 8006, Z = -0.826, p = 0.409). Russian LLC students (median = 0.84; mean rank = 998.94) scored higher on waste attitude than non-LLC students (median = 0.67; mean rank = 598.53). The difference in attitude scores between the groups was statistically significant (U = 136777.0, Z = -17.494, $p < 0.01$) and the effect size was large with larger values tending to be in the LLC sample (-0.55). Northern Ireland LLC students (median = 0.79; mean rank = 104.13) also scored higher on waste attitude compared to non-LLC students (median = 0.62; mean rank = 57.49). The difference in attitude scores between the groups was statistically significant (U = 1112, Z = -0.6.428 $p < 0.01$) and the effect size was large with larger values tending to be in the LLC sample (-0.61). These results are presented in Table 4.14.

Since the p-value is greater than the chosen significance level ($\alpha = 0.05$), the null hypothesis cannot be rejected and there is no evidence to suggest an association between the LLC and student scores

in waste attitude in Ireland. In Northern Ireland and Russia, the p-value is less than 0.05, and the null hypothesis can be rejected. There is evidence to suggest an association between the LLC and student scores in waste attitude in Russia and Northern Ireland.

Country		Q1 total score	Q5 total score	Q6 total score	Total attitude score
Ireland	Mann-Whitney U	7515.0	7892.0	8334.5	8006.0
	Wilcoxon W	16560.0	16937.0	16462.5	17051.0
	Z	-1.901	-1.016	-0.288	-0.826
	Asymp. Sig. (2-tailed)	0.057	0.31	0.774	0.409
Russia	Mann-Whitney U	210184.0	141553.0	158165.0	136777.0
	Wilcoxon W	604900.0	536269.0	552881.0	531493.0
	Z	-10.968	-16.951	-15.034	-17.494
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000
Northern Ireland	Mann-Whitney U	1370.0	1303.5	1297.5	1112.0
	Wilcoxon W	5375.0	5308.5	5302.5	5117.0
	Z	-5.848	-5.727	-5.756	-6.428
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000

Country	Test	Total attitude score	Total knowledge score
Ireland	Mann-Whitney U	8006.0	7231.5
	Wilcoxon W	17051.0	16276.5
	Z	-0.826	-2.126
	Asymp. Sig (2-tailed)	0.409	0.034
Russia	Mann-Whitney U	136777.0	162318.5
	Wilcoxon W	531493.0	557034.5
	Z	-17.494	-14.627
	Asymp. Sig (2-tailed)	0.000	0.00
Northern Ireland	Mann-Whitney U	1112.0	2210.5
	Wilcoxon W	5117.0	6215.5
	Z	-6.428	-2.39
	Asymp. Sig (2-tailed)	0.000	0.017

Table 4.14. *Wilcoxon Mann Whitney results of attitude scores in each country*.

4.5.2 Knowledge

Descriptive statistics showed that Irish LLC students (median = 0.5; mean rank = 141.06) did not score significantly higher on waste knowledge than non-LLC students (median = 0.5; mean rank = 121.47). The difference in knowledge scores between the groups was not statistically significant (U = 7231.5, Z = -2.126, p = 0.034). Russian LLC students (median = 0.58; mean rank = 959.34) scored higher on waste knowledge than non-LLC students (median = 0.42; mean rank = 627.29). The difference in knowledge scores between the groups was statistically significant (U = 162318.5, Z = -14.627, $p < 0.01$). Northern Ireland LLC students (median = 0.58; mean rank = 86.96) also scored higher on waste knowledge compared to non-LLC students (median = 0.5; mean rank = 69.84). The difference in knowledge scores between the groups was statistically significant (U = 2210.5, Z = -2.39 p = 0.017). These results are presented in Table 4.15.

Country		Q2 Total score	Q4 Total score	Total knowledge score
Ireland	Mann-Whitney U	7239	7947	7231.5
	Wilcoxon W	16284	16992	16276.5
	Z	-2.16	-0.944	-2.126
	Asymp. Sig. (2-tailed)	0.031	0.345	0.034
Russia	Mann-Whitney U	229365	168801	162318.5
	Wilcoxon W	624081	563517	557034.5
	Z	-6.932	-13.954	-14.627
	Asymp. Sig. (2-tailed)	0.00	0.00	0.00
Northern Ireland	Mann-Whitney U	2840.5	1978	2210.5
	Wilcoxon W	6845.5	5983	6215.5
	Z	-0.029	-3.306	-2.39
	Asymp. Sig. (2-tailed)	0.977	0.001	0.017

Table 4.15. *Wilcoxon Mann Whitney results of knowledge scores in each country*.

Since the p-value is less than the chosen significance level ($\alpha = 0.05$), in all three countries the null hypothesis can be rejected and there is evidence to suggest an association between the LLC and student scores in waste knowledge. The difference between the control and LLC was small in Ireland (cliffs delta = -0.15), large in Russia (-0.42), and medium in Northern Ireland (-0.22). Larger knowledge scores values tended to be in the LLC sample in all three countries.

4.6 Effect of age and gender

This section presents the effect of background variables, age and gender on the knowledge and attitude scores. As the knowledge and attitude scores are continuous variables and the independent variables consist of two or more categorical groups, a MANOVA analysis is recommended (Lund Research, 2018; Finch, 2016). The primary aim of MANOVA is to determine whether there is a statistically significant interaction effect. One of the advantages of using MANOVA, as opposed to making a multiple ANOVA, is that it may better portray real world relationships (Finch, 2016; Stevens,

2001). A treatment will affect participants in more than one way and the inclusion of more than one dependent variable will yield a more holistic picture (Stevens, 2001). If a statistically significant interaction effect is found, this indicates that the effect of the LLC on attitude and knowledge depends on students' gender, nationality, and age. MANOVA has several assumptions (Lund Research, 2018):

1. Two or more dependent variables.
2. Two or more independent categorical variables.
3. Independence of observations.
4. Adequate sample size.
5. No outliers.
6. Multivariate normality.
7. Linear relationship between each pair of dependent variables for all combinations of groups of your independent variables.
8. Homogeneity of variance-covariance matrices.
9. No multicollinearity.

The data violates the assumptions of adequate sample size, normality, and homogeneity of variance when more than three background variables are included in the MANOVA analysis. The more dependent variables measured, and the greater the differences in sample sizes, the more distorted the probability values become (Field, 2018). For this reason, only gender and age were chosen for analysis.

Descriptive statistics were used to evaluate group sizes; 15–18-year-olds were removed from the dataset to create adequate group sizes. Outliers were identified and removed using linear regression. Linear relationships between the dependent variables were confirmed using scatterplot matrices. The Pearson correlation coefficient was 0.44 indicating that multicollinearity is not an issue between the two dependent variables. Using the Shapiro Wilke test, the knowledge and attitude scores were both found to have non-normal distribution (p-value < 0.05) which violates the assumption of multivariate normality. MANOVA is robust to violations of multivariate normality if there are at least 20 cases in each group even if groups are unequal. Covariance matrices across dependent variables were found to be equal although, MANOVA has been shown to be reasonably robust to violations of this assumption, provided the

group size is similar and over 30 (Stevens, 1996; Allen & Bennett, 2008). Error of variance was also found to be equal across groups (Levene's test was not significant).

4.6.1 Independent variables and groups

Age had nine possible levels, but to simplify the analysis these were reduced to two levels: 9-11 years-old and 12-14 years-old, but the older group had a much smaller sample. 15–18-year-olds were removed from the analysis because there were too few for an accurate analysis. Gender had two levels – male or female. Programme also had two levels – EcoSchools (ES) or Young Reporters for the Environment (YRE). The number of YRE students was much smaller than ES students. Nationality had three levels – Russia, Ireland, or Northern Ireland. Northern Ireland had the smallest sample size, while Russia had a very large sample. Four groups were possible between age and gender. It is recommended to have more cases in each group than there are dependent variables (Lund Research, 2018b). If group sizes are different, then robustness cannot be assumed. Unequal sample sizes in some groups were caused mainly by age, programme, and nationality. All five independent variables could not be included in a single MANOVA analysis because of unequal group sizes. The combination of programme and nationality created severely unequal groups. For this reason, gender and age were focused on.

4.6.2 Results

A 2 (Gender) x 2 (Age) between-subjects multivariate analysis of variance was performed on two dependent variables: Total Attitude and Total Knowledge. With the use of Wilks' criterion, the combined DVs were significantly different by levels of gender (Wilks' $\Lambda = 0.97$, $F = 15.55$, $p < .01$, partial $\eta 2 = .027$) and age (Wilks' $\Lambda = 0.984$, $F = 9.09$, $p < .01$, partial $\eta 2 = .016$) in the control group. The interaction effect between age and gender in the control group is not statistically significant (Wilks' $\Lambda = 0.99$, $F = .66$, $p = .52$, partial $\eta 2 = 0.16$). Gender (Wilks' $\Lambda = 1$ $F = 0.073$, $p = 0.93$, partial $\eta 2 = .016$) and age (Wilks' $\Lambda = 0.996$, $F = 1.447$, $p = 0.236$, partial $\eta 2 = .004$) were not significant by level in the LLC group

but a significant interaction effect was found between gender and age in the control sample (Wilks' $\Lambda = 1$, $F = 0.117$, $p < .01$, partial $\eta 2 = 0$).

These results suggests that control students' scores were significantly dependent on their gender and age, but there was not significant interaction effect between the two. There were no significant results in the LLC sample, suggesting that the scores of LLC students do not depend on their age or gender. To investigate the impact of each effect on the individual DVs, a univariate F-test using an alpha level of .05 was performed. Pair-wise comparison followed by a univariate F-test indicates that the main effects of gender were significant on both attitude and knowledge scores in the control group with approximately equal effect. Non-LLC females showed higher means in attitude and knowledge (Table 4.16). Age affected attitude of non-LLC students, but not knowledge scores; 9–11-year-olds showed higher means in attitude (Table 4.17).

Univariate Tests										
Treatment	Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Paramete	Observed Powera
Control	Attitude	Contrast	0.835	1	0.835	30.254	0.00	0.027	30.254	1
		Error	30.426	1102	0.028					
	Knowledge	Contrast	0.253	1	0.253	8.717	0.003	0.008	8.717	0.839
		Error	31.927	1102	0.029					
LLC	Attitude	Contrast	0	1	0	0.016	0.90	0.00	0.016	0.052
		Error	13.244	824	0.016					
	Knowledge	Contrast	0.005	1	0.005	0.146	0.703	0.00	0.146	0.067
		Error	26.852	824	0.033					

Table 4.16. *Univariate test result of gender*

Univariate Tests										
Treatment	Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Powera
Control	Attitude	Contrast	0.243	1.0	0.243	8.814	0.003	0.008	8.814	0.843
		Error	30.426	1102.0	0.028					
	Knowledge	Contrast	0.085	1.000	0.085	2.933	0.087	0.003	2.933	0.402
		Error	31.927	1102.0	0.029					
LLC	Attitude	Contrast	0.00	1.000	0.000	0.027	0.868	0.00	0.027	0.053
		Error	13.244	824.0	0.016					
	Knowledge	Contrast	0.078	1.000	0.078	2.395	0.122	0.003	2.395	0.34
		Error	26.852	824.0	0.033					

Table 4.17. *Univariate test result of age*.

4.7 Chapter summary

This chapter analysed the effects of the LLC on students' attitude towards and knowledge of waste. Using CATPCA, the student questionnaire was analysed, and 12 variables were identified to represent components of waste attitude, while two variables represent the knowledge component in the

2021 dataset. The attitude variables had high internal consistency whereas the knowledge had low consistency, most likely due to the low number of variables and few response options. These variables were used to create a knowledge and attitude score for each student. Based on the statistical analysis of student scores, the LLC has a significant impact on students' attitude toward waste and knowledge of waste. When compared by country, the impact was seen in Russia and Northern Ireland with a large effect size in both countries. Russia had the largest sample size while Northern Ireland had the smallest. It should also be noted that the LLC is implemented through YRE in Northern Ireland. The LLC is implemented through ES in Ireland and Russia.

Gender and age had an influence on the scores of non-LLC students but there was not significant interaction effect between the two. Age and gender did not have an effect in the LLC sample. Non-LLC females showed higher scores in attitude and knowledge. Age affected only the attitude scores of non-LLC students. 9–11-year-olds showed higher attitude scores. These results suggests that control students' scores were significantly dependent on their gender and age; it also suggests that the LLC, and education generally decreases the influence of background factors on students' literacy.

5. Teacher perspectives

The effectiveness of the LLC and other ESE programmes relies heavily on teachers and their perceptions have a significant role in their teaching methods and how they prepare their students. This chapter aims to determine how teachers perceive the effect of the LLC on students and what aspects of the LLC are effective. Descriptive statistics was used first to present questionnaire responses and thematic analysis was used on open-ended questionnaire responses.

5.1 Statistical analysis of teacher questionnaire responses

5.1.1 Questionnaire and participants

Teachers who participated in the 2021 teacher survey were from Ireland, Russia, Northern Ireland, and Spain, France, and Northern Ireland. All countries that participated in the teacher questionnaire were included due to the limited number of responses. ES teachers were from Ireland, Spain and Russia. YRE teachers were from Northern Ireland and France. A total of 48 schools were represented in the teacher questionnaire. The teacher questionnaire is presented in Appendix B and it consisted of 19 or 21 questions depending on the programme (ES or YRE). Background questions included school, gender, years of teaching, number of students at school, number of students in the LLC, and years running the LLC. The remaining questions assessed integration and implementation, curriculum and activities, perceived impact, teacher training and support, and teacher feedback.

5.1.2 Demographic data of teachers

81 teachers completed the questionnaire in 2021. 79% were ES teachers and 21% were YRE teachers. 8.6% were Irish, 49.4% were Russian, 6.2% were Northern Irish, 21% were Spanish, and 14.8% were French. 19.8% were male and 80.2% were female. 51.9% of these teachers had more than 15 years of teaching experience. 19.8% had 11-15 years of experience, 12.3% had 6-10 years, and 16% had less than 5 years of experience. School size ranged from less than 100 students to more than 1000 students; the

most common school size was 500-1000 students. 34.6% of teachers had been running the LLC for less than one year. 21% had been running it for 1-2 years. 17.3% had run it for 3-4 years and 23.5% had run it for more than five years.

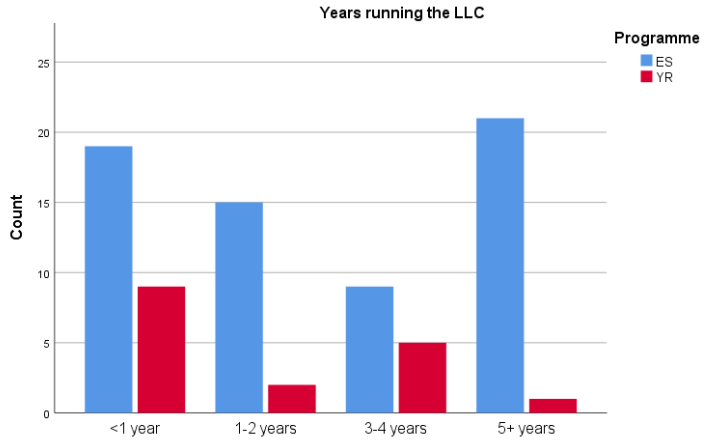

Figure 5.1. *Years running the LLC by programme*.

5.1.3 Integration and implementation

Teachers were asked to rate the implementation of ESE at their school. 38.30% of LLC teachers reported that there are no other environmental programmes or campaigns taking place at their school. 9.90% said that Learning about Forests (LEAF) was also taking place at their school. 22.2% said that their school also participated in YRE. 60.5% participated in programmes not listed and the most common was EcoSchools/Green Flag. Eco-Schools and Green Flag were not listed as an option which explains this. Other mentioned programmes were not connected to FEE and varied in size and topic: international and local programmes were mentioned, but many were also focused on waste education. Other programme focuses were ecology, climate change, and marine science. These responses indicate that most schools participate in ESE programmes other than the LLC, and many schools participate in programmes outside of FEE.

Teachers were also asked to rate the integration of ESE at their school. 60.5% of teachers reported a high degree of integration of environmental subjects in the school curriculum. 65.4% reported a high degree of implementation of environmental programmes and campaigns. 48.1% reported a high degree and 43.2% reported a medium degree of student involvement in outdoor activities during school time. Three teachers commented that the integration of environmental subjects in curriculum was not systemic and relied on the commitment of the teacher.

5.1.4 Curriculum and activities

Teachers were asked to describe their use of the curriculum topic choices and their responses can be seen in Table 5.1. In each country, teachers select the topics from a pool of topics chosen by the national operator. In some countries waste topics that are not listed are chosen and this was the most common choice. Other topics which were commonly mentioned by teachers were biodiversity, greenhouse gas emissions, carbon footprints, and food waste. The most common topic from the LLC topic list was responsible consumption (75.3% of teachers), followed by plastic pollution (74.1%), and packaging (61.7%). Electronic waste was the least common chosen topic.

Main topic covered	
Plastic pollution	74.1
Packaging	61.7
Responsible consumption	75.3
Hazardous waste	29.6
Marine pollution	18.5
Electronic waste	17.3
Organic waste	35.8
Other	86.4

Table 5.1. *Teacher response regarding topics chosen for the programme in percentage.*

Curriculum use. Teachers were asked about their use of curriculum resources and their responses can be seen in Tables 5.2 and 5.3. 34 to 50% of ES teachers reported a high use of all materials. 11 - 16% of ES teachers did not use any of the learning materials. 6 – 13% of ES teachers said they made little use any of the materials. The Guidelines for Monitoring of Litter and Waste in School was the least used material. ES teachers reported that the LLC lesson plans had the highest use. The most used material by YRE

teachers was the YRE website and the least used material was the webinars. Over half of YRE teachers also did not use the LLC lesson plans.

	Did not use	Low use	Medium use	High use
Guidelines for Monitoring of Litter and Waste in School	14.3	6.3	36.5	42.9
Litter Less Lesson Plans	12.5	7.8	29.7	50
The webinars on Circular Economy, Project Based Learning, Fostering Civic Participation and more	15.6	12.5	37.5	34.4
Litter Less Home Challenge	10.9	13	41.3	34.8

Table 5.2. *ES Teacher's reported use of curriculum materials*.

	Did not use	Low	Medium	High
Litter Less YRE Handbook	11.8	23.5	23.5	35.3
Litter Less Lesson Plans	52.9	23.5	11.8	5.9
YRE Website	5.9	0	23.5	52.9
The video tutorials on how to make articles, photos and videos	35.3	23.5	23.5	17.6
The webinars on Circular Economy, Project Based Learning, Fostering Civic Participation and more	70.6	17.6	5.9	0

Table 5.3. *YRE Teacher's reported use of curriculum materials*.

Teachers were also asked if they would like more teaching materials (Table 5.4). 84.4% of ES teachers said they would like more teaching materials. *Ideas for experiments* was the most popular material requested by the ES teachers. Writing tutorials were the most requested by YRE teachers (70.6%) followed by lesson plans (52%). Despite over 50% of YRE teachers never using the lesson plans, and only 6% getting high use out of them, they had the highest interest. Only 6% of YRE teachers said they did not want additional materials.

Text material	40.6
Ideas for experiments	76.6
Ideas for outdoor lessons	75
Links	42.2
Pictures	39.1
Powerpoint templates	35.9
PowerPoint drawing templates	21.9
Leaflets	50
Lesson plans	62.5
Webinars	53.1

Tutorials related to filming and film-editing	52.9
Tutorials related to writing an article	70.6
Tutorials related to photography and photo-editing	35.3
Lesson plans	52.9
Webinars	47.1
No, thanks	5.9

Table 5.4. *Teacher interest in additional materials in percentage (ES on the left and YRE on the right).*

LLC activities. Most ES teachers indicated that all the key LLC activities were carried out. 98.4% said that their students performed a waste and litter review at their school. 90.6% said that litter and waste issues were raised with the Eco-committee and 93.7% of teachers reported that an action plan was created to improve the issues. 86.9% of teachers said the issues were evaluated to determine whether they were resolved. 91.8% of teachers said students informed others about their efforts to resolve the issues and 87.5% of teachers said an Eco-code was created to address littering and waste management. The evaluation and monitoring of the waste issue had the lowest frequency followed by the creation of an eco-code.

	Yes	No
Carried out an environmental review about litter and waste	98.4	1.6
Raised specific litter and waste issues with the school's eco-committee	90.6	7.8
Created an action plan to resolve or improve the issues	93.7	6.3
Monitord and evaluated whether the issues were improved or resolved	86.9	13.1
Informed others about their efforts to resolve the issues	91.8	8.2
Produced an eco-code that addresses littering and responsible waste management	87.5	12.5

Table 5.5. *LLC activities carried out by students*.

All YRE teachers reported using the YRE 4-step methodology and that all students researched solutions to waste issues. 88.2% of teachers said students reported on a local waste issue and shared their work with their local audience. 43.8% of teachers said that their students presented in their Community Action Day. Fewer teachers (23.5%) said that their students exchanged experiences with students from other schools. Multiple teachers reported that their projects were hindered by the pandemic. The exchange of experience between schools had the lowest frequency followed by participation in Community Action Day.

Teachers described activities within the school community which included eco-teams and eco-clubs. They guided students while they participated in various eco-club activities, helped the eco-team organise the LLC activities, organised eco meetings, and promoted different environmental-based activities within and around the school. LLC teachers also described activities outside the school

community. Teachers reported participating in and organising outside school activities like community tree planting, beach clean-ups, birdwatching, and tours of waste treatment and processing sites.

5.1.5 Perceived impact

Several of the questions were centered on teachers' perceptual assessment of the LLC's impact on knowledge or behavior, students' skills, and noticeable changes at their school. Most teachers reported a positive impact but some of the teachers were not very certain if they could conclusively say that the LLC had an effect.

Knowledge and skills. Both ES and YRE teachers were asked about their students' familiarity with waste topics. Most teachers reported that their students were familiar with the topics in Table 5.6. All teachers reported that their students were familiar with recycling, but no other topic received 100%. A high percentage of teachers thought their students were familiar with waste sorting, sustainability, re-use of waste, and waste prevention. 42% of teachers said students were not familiar with incineration. Decomposition was the next most unfamiliar topic with 30.9% of teachers saying students were unfamiliar with the topic.

	Familiar with the topic	Unfamiliar with the topic
Recycling	100	0
Composting	76.5	23.5
Incineration	58	42
Landfill	82.7	17.3
Waste sorting	98.8	1.2
Decomposition	69.1	30.9
Sustainability	90.1	9.9
Re-use of waste	92.6	7.4
Waste prevention	93.8	6.2

Table 5.6. *Teacher response regarding students' familiarity with waste topics*.

YRE teachers were asked what skills students achieved through the program (Table 5.7). All teachers reported that students could identify a waste issue and produce an article/photo/video about an environmental issue. About half of teachers believed students could critically evaluate information, defend their point of view using collected information, and learn from the experience of others. YRE

teachers were asked which step of the four-step process was the most difficult for students: 41% said the sharing of work was the most difficult followed by the reporting on a local issue (35%). 11.8% said investigating a local issue was the most difficult and 5.9% said researching the issue was the most difficult step. All YRE teachers said that they used the four-step process.

	Yes
The ability to identify a local waste issue	100
The ability to analyze a waste issue	76.5
The ability to collect information from various sources	88.2
The ability to critically evaluate information	52.9
The ability to explore solutions for a specific environmental issue	76.5
The ability to produce an article, photo or video about an environmental issue	100
The ability to describe their work to others	64.7
The ability to defend their point of view using the information collected	52.9
The ability to learn from the experience of others	52.9

Table 5.7. *YRE teacher's perception of student knowledge in percentage*.

Behavior. Teachers were also asked to report on the behavior change of their students. Most teachers reported a mid to high impact on student behavior for each sub-item (Table 5.8 and 5.9). 37.5% of ES teachers said the LLC had a high impact students' awareness of their own behavior. Most ES teachers thought students became aware of their own behavior and the negative effects of littering and waste production. Teachers thought there was less of an impact on litter improvement at the school and even less impact on students encouraging others to change waste behavior.

	1 (Low impact)	2	3	4	5 (High impact)
Students became conscious of their own behaviour	0	3.1	15.6	43.8	37.5
Students became aware of the negative effects of littering and waste production on the environment	0	1.6	9.4	40.6	48.4
Students encouraged friends and family to change behaviour	1.6	10.9	28.1	29.7	29.7
The school and/or the local area are cleaner	1.6	4.7	7.8	37.5	48.4

Table 5.8. *ES Teacher's perceived impact of the LLC on student behavior in percentage*.

70.6% of YRE teachers said the LLC had a moderately high (4) impact on students' awareness of their own behavior. Resolution of the litter or waste issue was rated lowly: 20% said it was low (1), 33.3% said it was slight, and 40% were neutral (3). Teachers commented that full potential was not reached due to the pandemic and that some issues are too large for them to see an effect, but they still do it to raise awareness. Another teacher described that their community is cleaner and paper and plastic waste has reduced. The variety of responses illustrates the different circumstances and issues that each school faces.

	1 (Low impact)	2	3	4	5 (High impact)
They became conscious of their own behaviour	0	0	5.9	70.6	23.5
They raised awareness about the issues investigated	0	5.9	17.6	41.2	35.3
They encouraged others to act or to change behaviour	0	5.9	11.8	58.8	23.5
The problem was resolved	20	33.3	40	6.7	0

Table 5.9. *YRE Teacher's perceived impact of the LLC on student behavior and final result in percentage.*

The majority of ES teachers said the LLC had a positive effect on student behavior (Table 5.10). They reported that their students were highly likely to pick up litter they see, approach other students they see littering, and report a student they see littering. YRE teachers had more mixed reports: 58.8% said students were highly likely to pick up litter they saw and mobilize family and friends to solve a litter issue. 11.8% of teachers thought students were highly likely to approach another student about littering and 29.4% thought it was highly likely that students would contact the authorities about a waste issue (Table 5.11). More ES teachers were certain that the LLC had a significant effect compared to YRE teachers.

	1 (Unlikely)	2	3	4	5 (Highly likely)
Students would pick up litter they see lying around in the school	1.6	4.7	0	14.1	79.7
Students will approach other students they see littering and ask them to pick it up	4.7	1.6	0	20.3	73.4
Students report a student they see littering	4.7	7.8	0	21.9	65.6

Table 5.10. *ES Teachers' prediction of student behavior in percentage.*

	1 (Unlikely)	2	3	4	5 (Highly likely)
Would pick up litter they see lying around in the school	5.9	0	0	35.3	58.8
Will approach other students they see littering and ask them to pick it up	0	17.6	0	64.7	17.6
Report a student they see littering	23.5	17.6	0	47.1	11.8
Contact the local authorities to report on a waste problem	11.8	47.1	0	11.8	29.4
Will mobilize family and friends to solve a littering incident in their community	5.9	5.9	0	29.4	58.8

Table 5.11. *YRE teacher's prediction of student behavior in percentage.*

5.1.6 Teacher training and support

70.3% of the ES teachers reported that they watched the LLC introduction video. The majority of teachers said the video gave them a high level of understanding in all aspects: understanding the LLC's purpose, planning implementation, explaining the skills that students would learn, understanding how to apply the skills learned in the video, explaining where to get more information about the campaign, integrating the LLC with curriculum, and how evaluation of the LLC takes place (Figure 5.2). Explaining how the LLC is evaluated was given the lowest rating.

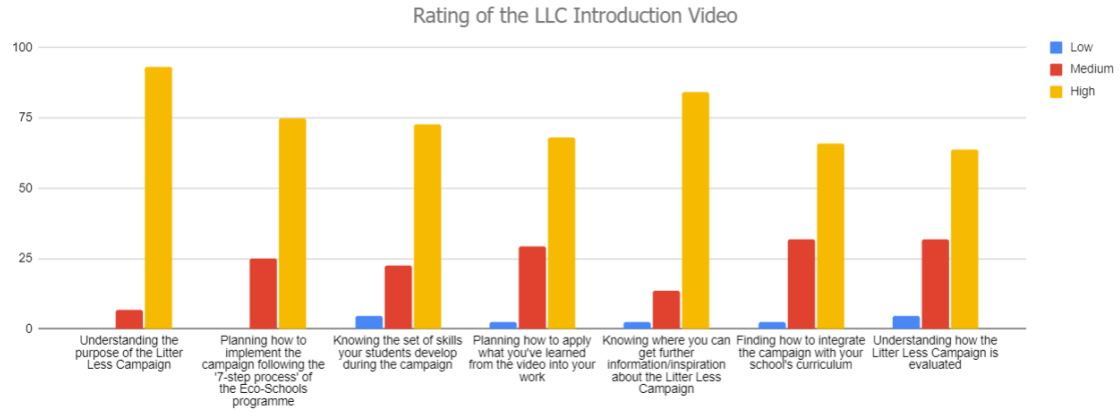

Figure 5.2. *ES Teachers' rating of how the LLC introduction video helped their understanding of certain aspects (in percentage).*

Most YRE teachers did not attend a YRE LLC training workshop. Only two YRE teachers indicated that they attended. Thus, only two responses were collected for the sub-items which asked them

to rate how the workshop helped their understanding of the programme. Each item received one high and one medium rating (Table 5.12). The low attendance in training may explain the lack of awareness regarding curriculum materials.

	Low	Medium	High
Understanding the purpose of the Litter Less Campaign	0	50	50
Describing the '4-step process' of the YRE programme	0	50	50
Knowing the set of skills your students develop during the campaign	0	50	50
Planning how to apply what you've learned from the workshop into your YRE work	0	50	50
Knowing where you can get further information/inspiration about the Litter Less Campaign	0	50	50
Finding how to integrate the campaign with your school's curriculum	0	50	50
Understanding how the Litter Less Campaign is assessed	0	50	50

Table 5.12. *YRE teachers' rating of the LLC training workshop*.

5.2 Thematic analysis of teacher responses

5.2.1 Methodology

To understand teacher perspectives, open-ended responses were analysed using Braun and Clarke's (2006) approach. Data which were meaningful to the study were noted, recurring messages were identified, and codes were generated in the form of phrases to represent significant data. The codes chosen aimed to identify the elements that the teachers noted as important to them in their responses (Ilse Benavides-Lahnstein & Ryder, 2020).

5.2.2 Themes of teachers' free responses

12 questions from the teacher questionnaire had free response options which allowed teachers to elaborate on the question. Ten free response questions which related to impact and feedback were thematically analysed to understand teachers' view of the programme and what works well and what needs improvement. The final question provided the largest amount of data and it asked teachers to explain what

elements of the LLC worked well. From all of the responses, eight themes were identified and are presented in order of prevalence, and each is described with examples in Table 5.13

Waste management activities/actions

Teacher comments describing waste management activities or actions carried out at their school were the most frequent. Actions focused on their chosen waste issues and related to waste collection, reduction, and prevention. Waste topics varied from carbon emissions to marine waste. Activities included waste monitoring, sorting, recycling etc. School actions included: creation of a repair café, changes to the school yard, and changes at the school canteen to reduce waste.

LLC Resources and methodology. Teachers noted that students enjoyed the LLC lessons, and that the LLC methodology was easy to follow. Many teachers thought the lessons were highly relevant and practical. One teacher mentioned that they felt FEE supported teachers with resources throughout the year. Teachers commented that the resources allowed them to take part in larger eco-initiatives by connecting them to people, ideas and funding that would have otherwise been more difficult to attain if they were not part of the programme. One teacher said, “the financial incentive is so important. We got to buy a wormery for our school & will invest in a hot composter too. We might not have done this with the guaranteed funding.”

Conversely there were teachers who did not use the LLC teaching resources. Reasons for not using the materials fell under the following categories: lack of awareness or consideration, relevance, and time. The most common reason for not using the LLC materials was that they were unaware of its existence. Others stated that they had not thought if it. Another reason teachers did not use the curriculum materials cited was because of relevance. Some did not use curriculum materials because they were not relevant to their topic and some teachers created their own materials Additionally, with some countries there is the language barrier issue. The curriculum materials are provided in English, Spanish, French, and Portuguese but and one teacher requested that they be made in Russian.

Awareness. Teachers agreed that their school community had become more aware of their impact as it relates to waste. Teachers also reported that they noticed increased concern regarding waste issues and this resulted in teachers and students changing waste related behavior. Additionally, teachers thought the LLC increased waste awareness at home. One teacher mentioned that waste issues are too large to be solved but the LLC does raise awareness.

Students' engagement/involvement. Teachers commonly mentioned that students engaged strongly with the LLC and took ownership of the programme. Students' involvement is a key part to the success of any ESE and number of teachers said students' involvement dictates the success of the LLC. Teachers said that the LLC also encouraged students to break away from their family's waste habits and others mentioned that the LLC involved students' families, especially through waste monitoring at home during lock-down. Teachers mentioned that certain activities engaged different groups of students. YRE teachers expressed that students gained confidence and gained a "sense of belonging" through the LLC.

Collaboration. Collaboration among teachers and among students was an important part of the LLC according to teachers. Several teachers highlighted that the COVID-19 pandemic hindered activities and prevented students from working together but some reported that they were still able to have outdoor activities. One teacher said that they make their own lesson resources for the LLC and share these with other teachers.

Local community involvement. Activities described by teachers often involved their local community. Some schools worked with the local authorities to solve a waste issue. Others partnered with local waste management organisations to process a specific type of waste. Teachers mentioned that partnerships with the local community worked well and were highly valued.

Time demands. Multiple teachers agreed that with time constraints and curriculum requirements the success of the LLC was limited. Additionally, the pandemic was cited as a time constraint by teachers as it required teachers to re-organise their regular classes. Several teachers said time was a limiting factor to using the LLC materials. One teacher said, “the curriculum is saturated and allocating time can be an issue”.

Monitoring and evaluation. Teachers reported that the LLC had significant effects such as cleaner campus and increased recycling, while others reported no effect. For example, one teacher reported that it was too difficult to measure if campus was cleaner. Regardless of effects, most teachers thought the LLC was practical and beneficial to students, although it was difficult to gauge due to online schooling. For monitoring their school’s progress, one teacher said that the student impact questionnaire worked well, and another said that monitoring the project stages was effective.

Theme	Description	Examples
Waste management	Activities, actions, and results related to waste.	*Monitoring the bins worked well, especially when the children were given ownership of that task.*
		Waste paper collection is actively carried out at school, children do not throw paper into the trash, collect and hand over. Parents are involved in this work. Lessons are held in elementary school on competent waste sorting. Batteries are collected and returned. actively collect and hand over plastic and bottle caps.
Resources and methodology	Curriculum materials and methods used to implement the LLC.	*We have not found material adapted to our center of interest. We have generated the material from the center, the "decarbonize" dossier edited by the Junta de Andalucía, and various materials and resources obtained through the internet.*
		Community Action Day and the Eco-code worked well.
Awareness	Knowledge and concern about waste issues.	*Pupils develop confidence and enjoyed sharing their recycling ideas, as well as carrying out parish litter picks and discussing the issues around plastic pollution, particularly with Covid-19 having reintroduced some plastic use back into school, e.g. plastic disinfectant bottles, masks etc. They noticed more gloves being thrown away in their local areas and were disgusted by this.*
		The awareness-dissemination of the problem we had with waste in lunch and the adoption of measures from home to reduce it.
Student involvement/engagement	Students' participation, ownership, and ownership of the LLC.	*What has worked best has been delegating certain tasks to the students (control of paper containers, weighing garbage, ...)*
		These are teenage boys and some are less confident than others. As they get a little older I feel they will find engaging with the local audience a little easier.
Collaboration	Teachers working together or students working together to implement the LLC.	*Having been involved with YRE for a number of years I have developed some resources and have made links with other departments within my school which have helped in the production of work.*
		Working together as a team worked well.
Local community involvement	Collaboration and participation of the local community with the LLC.	*There was a second memory garden developed in Susan's Trail where the local community were invited to plant trees in memory of loved ones, in a socially distanced manner. In total there are now 450 loved ones remembered in the area. Pupils were involved in preparing the area, planting their own trees for family, and getting things ready for other members of the community.*
		Eco-delegates are also currently working with the town hall on projects related to soft mobility.
Time demands	Time requirements or limitations which impact implementation.	*All the elements worked well (especially the tutorial and plan aids, visio and the permanent accompaniment of our project to help us follow the steps well) but with an audience of second-year students who arrive at the high school (not knowing each other at the beginning of the year) it takes time to join, and understand.*
		Pupils attended the international YRE webinars last year during the first lockdown, and again in this lockdown on a variety of these topics. They shared some of their ideas also. During a normal school day it can be difficult to schedule these webinars so that was a positive of the lockdown.
Monitoring and evaluation	Formal evaluation of the LLC's results and informal assessment of achievements	*The organization has always been aware of development and we have had a lot of Feedback from them.*
		Monitoring achievements (project stages) and lessons.

Table 5.13. *Examples and descriptions of themes from teacher perspectives.*

5.3 Teaching and learning methods

Teachers were not directly asked to describe their teaching methods or teaching style, but some methods can be inferred from the questionnaire comments and examples are shown in table 5.14. Most teaching and learning methods focus on one of the following: content, interactivity, critical-thinking, production, problem-solving, or reflection (University of Tasmania, 2021). Methods mentioned by LLC teachers focused mainly on interactivity, problem-solving, production, and critical thinking. From the

questionnaire, teachers did not seem to focus on content or reflection, but this could be because they are not emphasizing lecturing or assessment methods. From the teachers' questionnaire comments, it's clear that many LLC teachers used learner-centered, participatory methods. These include fieldwork, inquiry or investigation, discussion, production, and community events (Scoullos, 2013). Participatory methods have a strong focus on collaboration, critical-thinking, and active learning which explains why interactivity, problem-solving, and production were the common focuses.

Teaching methods	Teacher examples
Fieldwork or field trips	*Regarding compost and decomposition, they have worked in the school garden with a composter that they manage themselves. Re-use: we have the re-use corner for art and technology. Prevent waste: with the YRE project we believe that there has been a great awareness. As for incineration and landfill, we have been pending, since we have not been able to go to the incinerator in Mallorca, this year we have not made any school outings, but it is an annual trip to secondary and primary schools.*
Inquiry/investigation	*The interviews that allowed an awareness on the part of the interviewees*
Problem solving	*The student survey focused on the measures taken in the school canteen to limit food waste, and on the behavior of users in relation to their consumption and the waste of bread*
Production	*#TacklingPlasticNI Young Reporters for the Environment 2020 - Video Celebration St. Colm's pupils placed 1st and 2nd in the photo competition https://www.youtube.com/watch?v=amm42M4kCXQ Will make more use of Litter Less Lesson Plans and webinars, difficult to implement and monitor with lockdowns.*
Group learning	*In addition to the newspaper, they also created a board game on sorting.*
Community events	*We participate in environmental events in the city to collect batteries and plastic*
Discussion	*Pupils develop confidence and enjoyed sharing their recycling ideas, as well as carrying out parish litter picks and discussing the issues around plastic pollution, particularly with Covid-19 having reintroduced some plastic use back into school, e.g. plastic disinfectant bottles, masks etc. They noticed more gloves being thrown away in their local areas and were disgusted by this.*
Student ownership/leadership	*What has worked best has been delegating certain tasks to the students (control of paper containers, weighing garbage, ...)*

Table 5.14. *Example of teaching and learning methods used by LLC teachers.*

Fieldwork. The fieldwork method includes the use of school ground and community to enable learners to interact with their environment gain practical experience and it was a common method used by LLC teachers (Corny & Reid, 2007; Jeronen et al., 2017). Multiple teachers described fieldwork as "outdoor activities" which focused on skill-building or inquiry. These activities included gardening, litter pick-up, waste collection, cleaning school grounds, litter and waste measurement, composting, and waste sorting.

Teachers reported that these activities seemed to have a significant effect on students because of their hands-on, experiential nature. Field trips were also commonly mentioned but many were disrupted due to Covid-19.

Inquiry/investigation. Experiments were not explicitly mentioned but inquiry/investigation was a common method, especially among YRE teachers. This included interviews, research on waste topics, and monitoring of waste issues on campus. Investigation methods were closely related to problem-solving methods and production. Production refers to students creating something which results in the development of knowledge, skills, or attitude. Inquiry and investigation were commonly used to find solutions to local waste issues and typically resulted in students producing or creating a report, video, or photo essay. Other production methods included arts and crafts using recycled materials or even the creation of shampoo bars.

Group learning. Group learning was done in various ways; group games, debates, and waste sorting were some common group learning activities. Multiple LLC teachers mentioned teamwork and collaboration as effective methods. Many of the LLC activities and lessons are group oriented and emphasize collaboration which explains why this was a common response. Students get the most out of this method when their group is heterogenous and students have different levels of skills (Al-Rawi. 2013).

Discussion. Discussion was another common method, and this is an important aspect of group learning. This method aims to reach a specific fact or truth through questions and dialogue (Al-Rawi. 2013). When discussion was mentioned by LLC teachers, it was noted as highly enjoyable for learners. Ideally, discussion provokes students to think critically and criticize their answers and the answers of others.

Community events. Community events were another common method which relies on collaboration and discussion. This is another aspect which is emphasized by the LLC. Information exchange and collaboration with other schools and local authorities is encouraged to address local waste issues. Teachers commonly mentioned that school events or actions such as Community Action Days, Eco-codes, and school waste mandates were effective on students and teachers. Community events with the wider community included waste drives and partnerships with local businesses.

Student ownership/leadership. Student ownership and leadership was another method mentioned by teachers as a successful way to engage students. Many teachers mentioned that they assigned tasks related to waste and litter collection, sorting, and weighing. Other student lead activities included presentations to the local community about a waste issue and leadership of the Eco-committee.

These are not the only methods employed by LLC teachers; online learning was commonly reported mainly because of Covid-19. Prior to the pandemic online learning was not usually combined with the LLC but some teachers reported that it made certain activities easier, such as watching the provided webinars. Common methods that were not mentioned in the questionnaire comments are lecturing and assessment. Most lessons require at least a short lecture to provide context, but this is typically the least engaging teaching method thus few teachers would mention it as a highly effective method for primary and secondary students (Al-Rawi. 2013). Assessment was not mentioned by teachers, most likely because it is not part of the LLC curriculum because FEE performs its own assessment of students. Lastly, it should also be noted that chosen teaching methods likely depend on an individual teacher's regular subject matter and perception of ESE (Anyolo et al., 2017; Uitto & Saloranta, 2017).

5.4 Chapter summary

This chapter has attempted to explore teachers' perceptions of the LLC and teaching practices to better understand how the LLC affects students. Based on the descriptive statistics and thematic analysis of the teacher questionnaire, teachers generally have a positive view of the LLC. More ES teachers thought the LLC had a high impact on student behavior compared to YRE teachers. Most ES teachers thought students became aware of their own behavior and the negative effects of littering and waste production, but teachers thought there was less of an impact on litter improvement at the school and even less impact on students encouraging others to change waste behavior.

Responsible consumption was the most common topic chosen from the LLC list and all teachers reported that their students were familiar with recycling. A high percentage of teachers thought their students were familiar with waste sorting, sustainability, re-use of waste, and waste prevention. 42% of teachers said students were not familiar with incineration followed by decomposition, with 30.9% of teachers saying students were unfamiliar with the topic. About half of teachers thought students were highly involved in outdoor activities.

Most ES teachers attended some form of training but almost none of the YRE teachers attended a teacher training. The majority of ES teachers reported that all the methodology steps were carried out and most teachers said that sharing their work, participating in Community Action Days, and exchanging with other schools was challenging. YRE teachers also agreed that sharing their work was the most difficult step for their students. Teachers reported a high degree of integration of environmental subjects in their school curriculum although some teachers commented that the integration of environmental subjects in curriculum was not systemic and relied on the commitment of the teacher. Implementation of environmental programmes and campaigns was reported to be high by most teachers. Many schools participate in ESE programmes other than the LLC, and most schools participate in programmes outside of FEE.

Thematic analysis showed that the most prevalent themes pertained to waste management activities, resources and methodology, awareness, collaboration, local community involvement, and student involvement. There was a high level of consistency in student involvement, awareness, collaboration, and local community involvement. Further analysis of teachers' questionnaire comments illustrated that fieldwork, investigation, problem-solving, production, group learning, community events, discussion, and student ownership and leadership were common teaching and learning methods used by LLC teachers. Online learning was also commonly used but teachers noted that this was mainly due to the Covid-19 pandemic.

Differences in perspectives were related to the LLC's impact on waste management; YRE teachers agreed that their chosen waste issue had not been solved, some teachers thought there was a significant improvement on campus, and others thought there was only an improvement in students' awareness. There were also differences regarding LLC resources; some teachers found the resources extremely useful and effective while others thought they were not relevant to their topic or did not know that some curriculum resources existed. The LLC lesson plans were popular with ES teachers but mostly unused by YRE teachers. YRE teachers mostly used the YRE website. 11 - 16% of ES teachers did not use any of the LLC learning materials and *The Guidelines for Monitoring of Litter and Waste in School* was the least used material. The low use of lesson plans and high request for them suggests that teachers either do not know of them or the lesson plans are unavailable to them because of language differences or topic choice. A small percentage of ES and YRE teachers (approximately 6%) said they did not want additional teaching materials.

6. National Operator perspectives

This chapter presents the perceptions of FEE's National Operators (NOs) in Ireland and Russia. It aims to provide a more complete picture of the LLC through the NOs perspective using Braun and Clarke's (2006) approach explained in the previous chapter.

6.1 Interview and participants

The NOs from Ireland and Russia were both interviewed and are referred to as NO 1 and NO 2, respectively. for approximately forty minutes. Each interview was transcribed verbatim, and the transcripts of these interviews can be viewed in Appendices H and I. Each NO gave permission for the transcript to be used in this study. Discussions focused on the implementation of the LLC in their respective country, the LLC's efficacy, areas of improvement, and strengths of the programme.

6.2 Themes of National Operator responses

6.2.1 Common themes

Eight common themes were found between the two interviews. Each theme is presented below in order of prevalence. Each theme is described along with an example from the codebook in Table 6.2.

Student involvement. Both NOs said the progamme is far more effective when it is student-lead. Student involvement was the most common theme between the two interviews. The success of the LLC depends on students' investment and decication to the programme because the results are reliant on their behavior. Successful schools make sure students have a large role in decision-making and implemention of action plans. When students see another student performing ERBs rather than just a teacher then more students may join in. It was commonly mentioned that student involvement was impacted by Covid-19 as it removed hands on experiences, but NOs said students benefitted from having control over waste

measurement at home as it instilled independence. It also meant that students were involving their parents at home.

Flexibility. Both NOs expressed that the LLC has a high level of flexibility in terms of requirements and options. This allows schools to address local, specific waste issues and create connections in their local community. Additionally, it allows teachers to adapt plans to their students abilities and ideas.

Collaboration. NOs described how collaboration plays an important role in implementation of the LLC. Many schools work with external organisations to achieve their waste goals; in Ireland some schools collaborate with community groups called *TidyTowns* which awards the cleanest towns in Ireland. In Russia schools have partnered with waste processing companies to target specific waste types. In both countries, a silver lining of Covid-19 was increased collaboration and communication with and between teachers. Online meetings and events were found to be very ueful in connecting teachers from all parts of Russia. It also made events available to more people, increasing collaboration. NO 2 also said that the age range of the LLC also encourages collaboration between kindergartens and regular schools in Russia. The international scope of the LLC and FEE more generally also encourages collaboration. Lastly, collaboration and involvement of students' parents had a significant impact in Russia and NO 2 said it made the programme easier to implement.

Teacher support. Both NOs said that they offer some training to teachers at the start of the school year. NO 1 said they try to check in with teachers regularly to gather waste measurements and ensure that they are on track with the campaign. They also said that online meetings due to Covid-19 have made it easier to meet with teachers. NO 1 noted that they try to provide all the resources that teachers need.

Monitoring and evaluation. Neither NO said that they perform their own formal evaluation of the LLC as they try not to overload teachers with more work. NO 1 said they try to assess how teachers are doing

through regular check-ins and updates. Regarding FEE's formal impact assessment, both NO's said it was a challenge to find control groups for the student questionnaire. In the Irish education system, most students are exposed to litter and waste education so most Irish students already have a baseline of litter and waste knowledge without the LLC. NO 1 said this challenge slows the programme down. NO 2 said it is easier to find control schools by having schools ask other schools. This is because the NO works for an orgnaisation outside the education system.

National curriculum/policy. NO 1 said that the main national initiative that probably influences schools is *TidyTowns*. In Russia, the national policy influences the waste measurement activity because schools can be cited for litter. Instead of measuring litter found on campus they choose one of the other options to avoid violating any policy. NO 2 also said, "the state makes efforts to establish waste separation so it makes sense to go alongside with that." Addionally, NO 2 mentioned that it was difficult to work with the authorities in the early years of the programme because they did not know about the LLC. Now that they are familiar with the programme it is much easier.

***School attributes*.** School type, size, and location influences the success of the LLC and any other education for that matter. NO 1 mentioned that it's usually small rural schools that want to join the LLC but their size can be a challenge when it comes time for the impact assessment because a certain number of students is needed from different age brackets. In Russia, all types of schools are eager to join the LLC and the NO said they have a wait list of schools who want to join because funding is limited.

Time demands. Both NOs said the waste measurement activity was a challenge timing wise due to changing seasons and the length of each term. Since each term is usually about six weeks and six measurements are required teachers find scheduling it as an activity difficult to do. NO 1 said that generally, time is always a contraint for teachers due to curriculum saturation. They said that this year has been especially difficult due to Covid-19; teachers had to re-arrange classes and schools were just trying

to catch up. Lastly, NO 1 said the timing of FEE's impact survey can be a challenge as some teachers have not finished the LLC.

Theme	Description	Example
Student involvement	Students' engagement, participation, and ownership of the LLC.	*Letting the students have ownership of the program and getting them involved in the decision-making process or creating the signs to put on the bins, or they're going around to the other classes and educating the other kids about what's meant to be done. Or some classes will have competitions where they'll have kind of like traffic light system to show how literate they've been and you know, then they'll gain like an extra 10 minutes of break time or something like that. If if they win or something like that I think giving the students kind of that little extra bit of ownership of it is really good.*
Flexibility	Each country and school has freedom in selecting curriculum topics and actitivities that fit their school's needs and their community.	*I had told them to focus on composting and brown bin waste and the year before we had been looking at single use plastics. To be honest I kind of just usually let them choose whichever lesson plans from the set lesson plans fit best for them. Once they've had a chance to have a look at them and and properly go through them, you know because I don't want to be too prescriptive in what I'm I'm making them do because every school is different. And it also depends on what class age group the teacher in the school has that's organizing it so. So I tend to whittle it down to the ones that I think are most age appropriate and and then let them kind of pick from there.*
Collaboration	Schools working with eachother or external organisations to solve waste issues.	*You know the age range for the campaign initially was from 5 till 12 years old and in Russia it means that students with children of five till seven years old are in the programme. That's why this campaign was very helpful for us to develop closer connections or closer cooperation between kindergartens and schools. And sometimes, for example, kindergarten was part of the campaign, but the local school wasn't. But anyway, the students in both educational institutions were involved in the activities and of course when we were interviewing students for the survey.*
Teacher support	Actions or materials which help teachers carry out the LLC.	*We were not able to arrange large scale events like cleanups or some other activities but the positive thing was that we moved to online format and then helped us to connect the schools from all over the country because due to the large territory of Russia we arranged events for European part and for the Siberian part of Russia. Let's say Asian part of Russia. But online activities, seminars, conferences, and all kinds of other activities were open to everybody. So maybe for the first time the teachers from the Far East could meet the teacher from the west and they listen to each other and ask questions and so on and so on. So there were transient negative things, but also there were some more possibilities we got.*
Monitoring and evaluation	Actions to determine what has been accomplished and what teachers need.	*In Ireland they all start off working on litter and waste for two years and then they would move on and work on energy conservation and then water conservation and so on. So anyone that's already worked on litter and waste they probably kind of have that down and that would be 90% of our schools have already worked through it, so it's actually quite challenging to find schools that haven't done too much on it.*
National currciulum/policy	The role of national policy or curriculum in the LLC implementation.	*We have a person employed at school who is responsible for cleaning in the school year. And we have to ask the person not to clean during measurement weeks. But it means that in case of local authorities come, they will have a problem. You know if there is litter. There shouldn't be any litter in the schoolyard. So this causes problems, but they they arranged some activities which widened their viewpoint on waste. For example, one of the kindergartens. Focused on the broken toys and they tried to reduce that.*
Time demands	Time requirement or time limitations which prevent implementation of the LLC.	*You know sometimes you'll have a really keen coordinator, but maybe the principle isn't that interested or just wants them to focus on the core curriculum. That's definitely been a an issue in the past year and a half, you know, because schools are just trying to catch up on maths, English and Irish and they don't have time to be focused on LLC.*

Table 6.1. *Description and examples of each common theme from NO interviews.*

6.2.2 Themes by country

Each interview produced unique themes that were specific to the NO's experience and country. These themes are presented in Tables 6.2 and 6.3.

Ireland

Introductory programme. The Irish NO highlighted that the LLC is a starting point in ESE, and FEE's programmes. They mentioned that most schools in Ireland join the LLC to get started with the Green

Flag. It acts as a steppingstone to larger, intangible environmental issues. Focusing on a tangible concept opens the door to more abstract issues such as greenhouse gas emissions.

Accountability. NO 1 expressed concern over schools that join the LLC but do not follow through. They expressed how they cannot monitor what is happening at every school so there is limited accountability. The waste measurement activity was a large part of NO 1's feedback; no matter how much training or how many instructions are given to teachers the measurements are not reliable.

Internal support. NO 1 said the main determinant of the success was the commitment and interest of the LLC coordinator at the school. They also said that the internal support from other teachers and the principal have a large effect. This is related to the school's culture; if teachers and staff are not inclined to change then it is an uphill battle.

Theme	Description	Example
Introductory programme	The LLC acts as an introduction to larger environmental issues and ESE.	*They're kind of doing it just for getting set up with green schools, so usually we take on schools for the LLC that are just starting out on green schools or Eco-Schools and they would already be working towards their litter and waste flag. So we use the LLC to kind of reinforce that and and obviously they get the funding with it and that supports them to work on it in terms of kind of local policies that they're working towards.*
Accountability	Unclear if programme requirements are carried out or carried out correctly.	*So yeah, I think maybe six measurements is just a little bit too many and. You never really know for sure. I know. Obviously we're trying to analyze the data as rigorously as possible, but you know, I can give them all the guidelines in the world about, you know, use the same students and measure for the same amount of time and whatever but you know you never really know if that's happening on the ground.*
Internal support	Support from teachers and staff at schools which affects programme success.	*You know, some coordinators kind of feel like they're, just on their own kind of trying to do this thing, and they might be working with the staff who are really uncooperative or or not interested in kind of giving up any free time to it, they might be the first time recycling was brought into the school properly or something like that. Or, you know, people are getting more strict on what can actually go in the recycling. Then and some teachers will kind of feel like they don't want someone to be kind of scolding them or telling them what they're meant to be doing.*

Table 6.2. *Themes unique to Ireland.*

Russia

Student attributes. NO 2 said that the age of students has a role in the LLC's impact; they noticed that results are faster with younger students. They also said that boys and girls engage with different activities of the campaign.

Practicality. NO 2 highlighted that the LLC is very feasible and practical. Large investments are not required, and teachers find the methodology straightforward. It offers hands on experiences and connects students to local issues.

Theme	Description	Example
Student attributes	Characterisitics of students which affect the LLC's impact.	*We also have kindergarteners on the board. And working with the younger children gets results quicker than with older ones. So samples of kindergartens and primary schools may divide the project which should run during the whole academic, here into subprojects, and they could for example get midway results and show the students there.*
Practicality	Aspects of the LLC which use feasible and hands-on experiences.	*There are advantages of implementation, for example, general concept step by step. It doesn't need any huge investments like for example improvement of water saving systems or whatever, or establishing some renewable sources of energy so it doesn't need any really great financing, right?*

Table 6.3. *Themes unique to Russia*.

6.3 Chapter summary

Eight common themes were found between the interviews with NOs: student involvement, flexibility, collaboration, teacher support, monitoring and evaluation, national curriculum/policy, school attributes, and time demands. Themes unique to Ireland were accountability, internal support, and the LLC as an introductory programme. Themes unique to Russia were student attributes and practicality. The responses of NOs suggest that the practicality, flexibility, and simplicity of the programme make it impactful; Both NOs agreed that the LLC has a positive effect on students and that the LLC a good introduction to ESE for schools which have not have much ESE experience. It can also be a good programme for introducing the local government to ESE as the LLC is low cost and can have visible results.

Finding control groups for FEE's annual impact survey was a challenge for both NOs, as it takes time to recruit new schools which can delay the whole programme. In Ireland, it is difficult to find schools which do not have experience with waste management. It was also indicated that socioeconomic status plays a large role in a school's participation which also influences control groups. To avoid this issue FEE could use a pre-test and post-test experiment design on the same group of students, eliminating the need for control groups.

The waste and litter monitoring activity was a large part of the feedback from NOs. They said that the litter monitoring activity was difficult to complete and unreliable. Both NOs mentioned that six measurements were too much for many teachers to accomplish. Additionally, the results of the measurement were not clear as each school is different, and methods are inconsistent. It was recommended by NO 2 that there should be one required criterion for all schools because giving teachers a choice made it confusing and unreliable. This suggests that the flexibility of the LLC may be at odds with accountability. With greater freedom each school case becomes more unique, and evaluation becomes more difficult.

7. Discussion and recommendations

7.1 Discussion of results

To solve litter and waste challenges, waste literacy is needed at the individual and community level as it enables individuals to make responsible decisions and support good public policy. Primary and secondary education is a critical time for forming positive environmental attitudes and behaviors as the effectiveness of interventions has been found to higher with younger students (Hanneman, 2013). The primary purpose of this research was to examine the effectiveness of the LLC in improving waste literacy of students in the 2020-2021 school year.

Student questionnaire

First, multivariate data analysis was used on student questionnaire responses; CATPCA found that 12 variables were identified to represent components of waste attitude, while two variables represented the knowledge component in the 2021 dataset. The attitude variables had high internal consistency whereas the knowledge had low consistency, most likely due to the low number of variables and few response options. Question 3 variables required self-estimation and represented a students' perception of knowledge thus could not be included in either attitude or knowledge scores. These results show that the attitude component of the questionnaire is consistently assessing one component while knowledge questions are assessing different scenarios using various formats of questions. Standardized assessment instruments can be used for future studies as they allow easier comparison across years and between ESE programmes. An example is the New Ecological Paradigm (NEP) Scale (Anderson, 2012). Such scales would also make it easier to compare teacher attitudes or with student scores.

Comparison of LLC and control students' knowledge and attitude scores found that the LLC had a significant positive effect overall as LLC students had higher scores. When compared by country, the impact was seen in Russia and Northern Ireland with a large effect size in both countries, but a significant

impact was not seen in Ireland; this could be because the control group had been also exposed to litter and waste education. The Irish National Operator said that many schools partner with Tidy Towns and it is difficult to find schools which have not participated in a waste literacy programme. Based on Ireland's results, it appears that the LLC has a significant effect when there is a deficit in in waste knowledge and attitude. It should also be noted that Russia had the largest sample size while Northern Ireland had the smallest. Also, the LLC has been active in Russia since 2011 and 2017 in Ireland and Northern Ireland. These factors likely contribute to the LLC's effectiveness and need to be considered when making programme adaptions.

Previous studies show that ESE programmes typically has a positive effect on knowledge and attitude and these results show that the LLC did have a positive effect, there was greater impact on attitude than knowledge. Krnel (2009) found that Eco-School students had slightly higher environmental knowledge, but their environmental attitude remained unchanged. Boeve-de Pauw and Van Petegem (2011 and 2013) also showed that Eco-School students demonstrated an increase in environmental knowledge, but there was no influence on their attitudes or behavior. This result may be due to the choice of knowledge questions which were analysed but it is also likely that the LLC is having a greater impact on attitude rather than knowledge because each school selects different waste topics to study thus waste knowledge is inconsistent between LLC schools. This illustrates again that each participating country should be evaluated individually and that the LLC needs to be adapted specifically for each country.

Analysis of students' background factors found that age and gender did not influence the scores of LLC students. Gender and age did influence the scores of non-LLC students but there was not significant interaction effect between the two. Non-LLC females showed higher scores in attitude and knowledge. Age affected only the attitude scores of non-LLC students and 9–11-year-olds showed higher attitude scores. These results suggest that control students' scores were significantly dependent on their gender and age; it also suggests that the LLC, and ESE generally, decreases the influence of background factors on students' waste literacy. Previous research suggests that early education has more bearing on student achievement than education at older ages. It's also been seen that older students tend to lose

interest in science and math in the middle school which explains the higher attitude scores of the younger control students (Hines, et al., 1986). It has also been found that boys and girls appear to complement one another in EL and suggests that there are synergistic teaching opportunities (Stevenson, Peterson, Bondell, Mertig, & Moore, 2013; Hines, et al., 1986). For example, female students could help male students develop pro-environmental attitudes while male students could help female students understand knowledge components. While gender and age did not appear to have an effect on the scores of LLC students, these background factors need to be considered when adapting any ESE programme to ensure student engagement.

Recycling, composting, and waste reuse were listed as common LLC activities by teachers and only a small percentage of LLC students (16%) thought decreasing consumption the most effective waste management strategy. 15% of non-LLC students thought decreasing consumption the most effective waste management strategy. 75% of teachers said responsible consumption was a chosen topic for their school yet 46% of LLC students thought recycling and composting were the most effective waste strategy. Additionally, all LLC teachers said that students were familiar with recycling and 94% reported that students were familiar with waste prevention. It is concerning that teachers thought students understood waste prevention when most students thought recycling was the best strategy. This result suggests that students did not connect their responsible consumption lessons to waste prevention.

Tucker and Douglas (2006) found that people equated waste prevention with recycling showing the overemphasis of recycling which can still be seen in LLC students' responses. Recycling is a well-known and widespread practice, but it comes with serious limitations (Bartl, 2014). Along with other waste solutions such as bioplastics and incineration, recycling justifies the use of single items and encourages individuals and companies to continue with current waste production. Waste prevention is key to waste management, but it requires a person to critically evaluate their own habits and adapt their own behavior. Additionally, the measurement of recycling is simpler than waste prevention, making it a more attractive metric when evaluating impact (Bartl, 2014). It should also be mentioned that waste prevention discourages consumption which counteracts the economic interests of stakeholders, such as Mars

Wrigley, the sponsor of the LLC. To adjust the consumer mindset and place the onus of waste production on manufacturers, the EU's waste management hierarchy needs greater emphasis and visibility in the LLC's lessons.

Teacher questionnaire

The teacher questionnaire was analysed with descriptive statistics and showed that most teachers think the LLC has a positive effect on students and the school community. 24% of YRE and 48% of ES teachers said the LLC had a high impact on student behavior. This could be attributed to the different age groups of the YRE and ES. Most ES teachers thought students became aware of their own behavior and the negative effects of littering and waste production. Teachers thought there was less of an impact on litter improvement at the school and even less impact on students encouraging others to change waste behavior.

Thematic analysis also showed that teachers have a positive view of the LLC and the most prevalent themes pertained to waste management activities, resources and methodology, awareness, collaboration, local community involvement, and student involvement. There was a high level of consistency among teachers regarding student involvement, awareness, collaboration, and local community involvement. These aspects are emphasized by the LLC curriculum and ESE methodology which explains their recurrence (FEE, 2020; Anyolo et al., 2018). Differences in perspectives were related to the LLC's impact on waste management; YRE teachers agreed that their chosen waste issue had not been solved, some teachers thought there was a significant improvement on campus, and others thought there was only an improvement in students' awareness of waste issues but not behavior.

There were also differences regarding LLC resources; some teachers found the resources extremely useful and effective while others thought they were not relevant to their topic or did not know that some curriculum resources existed. The LLC lesson plans were popular with ES teachers but mostly unused by YRE teachers. YRE teachers mostly used the YRE website. Differences in material use are likely due to the different learning goals of ES and YRE and also age differences of YRE and ES

students. 11 - 16% of ES teachers did not use any of the LLC learning materials and *The Guidelines for Monitoring of Litter and Waste in School* was the least used material suggesting that this activity was not taking place as recommended. The low use of lesson plans and high request for them suggest that teachers either do not know of them or the lesson plans are unavailable to them because of language differences or topic choice. A small percentage of ES and YRE teachers (approximately 6%) said they did not want additional teaching materials suggesting that there is a lack of LLC learning materials which has been cited as a common barrier to ESE (Ilisko et al., 2011; Summers et al., 2005). This is likely connected to teacher training as most YRE teachers did not know about resources but were interested in additional materials.

Most ES teachers (70.3%) reported that they watched the LLC introduction video and gave it a high rating for explaining aspects of the LLC. Almost none of the YRE teachers attended a teacher training which is a concern since lack of teacher training is another common ESE barrier which has been previously cited by teachers (Borg, Gericke, Höglund, & Bergman 2014; Corney, 2006; Kimaryo, 2011; Uitto & Saloranta, 2017). Most ES teachers reported that all the methodology steps were carried out and most teachers said that sharing their work, participating in Community Action Days, and exchanging with other schools was challenging. YRE teachers also agreed that sharing their work was the most difficult step for their students.

Responsible consumption was the most common topic chosen from the LLC list and all teachers reported that their students were familiar with recycling, but no other topic received 100%. A high percentage of teachers thought their students were familiar with waste sorting, sustainability, re-use of waste, and waste prevention. 42% of teachers said students were not familiar with incineration followed by decomposition, with 30.9% of teachers saying students were unfamiliar with the topic. As previously discussed, LLC teachers indicate that their students are familiar with waste prevention but student responses illustrate that LLC students do not understand the EU's waste management hierarchy.

Teachers reported a high degree of integration of environmental subjects in their school curriculum although some teachers commented that the integration of environmental subjects in

curriculum was not systemic and relied on the commitment of the teacher. Implementation of environmental programmes and campaigns was also reported to be high by most teachers and many schools participate in ESE programmes other than the LLC, and most schools participate in programmes outside of FEE.

Successful learning is closely related to teaching and learning methods used by teachers (Olsson et al., 2016). Analysis of teachers' questionnaire comments illustrated that outdoor activities or fieldwork were a common method used by LLC teachers. Fieldwork is considered to be a particularly effective participatory method in addition to first-hand experiences and field trips and may explain the positive effect of the LLC on students' waste attitudes and knowledge (Jeronen, Palmberg, & Yli-Panula, 2017; Corney and Reid, 2007). Investigation, problem-solving, production, group learning, community events, discussion, and student ownership and leadership were also common teaching and learning methods used by LLC teachers.

Missing from the teacher questionnaire were teachers' perceptions of ESE and its purpose. Anyolo et al. (2018) illustrated teachers' perceptions of ESE and how these perceptions influenced their teaching methods; teachers defined ESE as education for a sustainable future, as skills-based education, as education for sustaining resources, or education for environmental awareness. Different teacher perspectives were also found according to their teaching subjects (Sund, 2016; Uitto & Saloranta, 2017). This information would be helpful in determining whether teacher perspectives and teacher experience affect the waste attitude and knowledge scores of LLC students.

National Operator perspective

Interviews with the Russian and Irish NOs were thematically analysed and eight common themes were found: student involvement, flexibility, collaboration, teacher support, monitoring and evaluation, national curriculum/policy, school attributes, and time demands. Themes unique to Ireland were accountability, internal support, and the LLC as an introductory programme. Themes unique to Russia were student attributes and practicality.

Both NOs agreed that the LLC has a positive effect on students and that it is a good introduction to ESE for schools who have not have much ESE experience. It can also be a good programme for introducing the local government to ESE. Both NOs also expressed that the success of the LLC was based on student involvement, collaboration, and local community involvement. These results overlap with the methods used by LLC teachers. The most common methods used by LLC teachers included fieldwork, student leadership and ownership, group learning, discussion and community events. This overlap with teaching methods suggests that the positive effect of the LLC is due to the participatory methods of ESE.

Finding control groups for FEE's impact assessment survey was highlighted as a significant challenge in both Ireland and Russia. In Ireland, it is difficult to find schools which do not have experience with waste management. It was also indicated that socioeconomic status plays a large role in a school's participation which also influences control groups. To avoid this issue FEE could use a pre-test and post-test experiment design on the same group of students, eliminating the need for control groups. Finding control groups for FEE's annual impact survey was a challenge for both NOs, as it takes time to recruit new schools which can delay the whole programme.

The waste and litter monitoring activity was also a large part of the feedback from NOs. The results of the measurement were not clear as each school is different, and methods are inconsistent. It was recommended by NO 2 that there should be one required criterion for all schools because giving teachers a choice made it confusing and unreliable. This suggests that the flexibility of the LLC may be at odds with accountability. With greater freedom each school case becomes more unique, and evaluation becomes more difficult. To measure the LLC's impact on behavior change, the waste and litter monitoring activity could be used but adaptations are needed. Limiting the criteria could also help address reliability and credibility by standardizing the measurements being taken. Since teachers have five options to choose from this creates a wide variety in what is being measured. The measuring of paper should be avoided as it encourages families to bring their paper waste to school which can create a large bias in measurement. National Operators said six measurements was too much for teachers but if this was reduced then it may result in even fewer than four completed measurements and be statistically

insufficient. Another option is to have an employee or volunteer from the National Operator visit on waste measurement days to assist teachers ensure valid measurement.

7.2 Implication for theory and practice

Based on the Theory of Change, the results of this research suggest that the increased knowledge and improved attitudes of LLC students will eventually lead to medium and long-term outcomes such as students' participating in ERBs, increased involvement and dedication to environmental issues, increased support for waste prevention from school staff and families, a reduction in waste and consumption, a strong emphasis of the circular economy on campus, and the adoption of lifelong ERBs by students. It is tempting to assume that the positive effect of the LLC on attitude and knowledge in Northern Ireland and Russia guarantees these medium and long-term outcomes, but without reliable observational data this cannot yet be proven. Other studies have analysed the intermediary and long-term outcomes of other ESE programmes with mostly positive results. Farmer, Knapp, and Benton (2007) reported that a year after an ESE field trip, most elementary school students retained their environmental knowledge and had developed pro-environmental attitudes. Hanneman (2013) also reported a positive outcome and found that students demonstrated long-term retention of environmental knowledge three to five years after participation in an ocean pollution education programme. Chan, Hon, Chan, & Okumus (2014) also illustrated that recycling knowledge predicted recycling activities. Additional studies indicate that as environmental knowledge and awareness increase, ERB also increases (Ajzen, 1991; Mostafa, 2009; Tudor et al., 2009; Zsóka, Szerényi, Széchy, & Kocsis, 2013) but it is also known that knowledge and attitude are not enough to change behavior. Even with today's current knowledge people still choose to smoke, overeat, and litter; education is not enough to mitigate and prevent environmental threats as the knowledge-attitude-behavior model suggests. Tudor et al. (2009) show that there are cultural and organizational factors which impact an individual's sustainable behavior. The results from all three countries also illustrate that factors outside the scope of this study influence the effect of the LLC. To

determine whether increased waste knowledge and improved attitude result in sustainable behavior more research is needed.

The efficacy of the LLC appears to vary by country which can be related to national waste policy, national curriculum, students' baseline knowledge, cultural norms, and other factors. These aspects need to be considered when implementing the LLC and other ESE programmes and it is recommended that FEE analyses the effect of the LLC in each country separately using a longitudinal approach. As previously mentioned, a longitudinal approach would also eliminate the issue of control groups as it would evaluate students before and after they participate in LLC. Litter and waste are common, global problems which makes it difficult to find truly neutral control groups. A longitudinal evaluation would also illustrate each student's baseline knowledge and inform teachers of what needs to be focused on during that school year. Using this approach, the effect of the LLC in countries with numerous ESE programmes, such as Ireland, would be clearer. A one size fits all approach ignores local factors which can result in lower efficacy and wasted efforts and funds. Country and school specific programme adaptions are needed to consider students' baseline knowledge and address local waste behaviors. Specific country and school adaptations would ensure that the LLC is meeting the needs of students and the local community.

Waste education is essential to sustainable waste management, but it is just one part of the solution. To prevent injuries, clinicians recommend following the "three Es" - education, engineering, and enforcement (Arlinghaus & Johnston, 2017) and these can also be applied to waste issues to meet the EU's 2050 vision. In practice, these results demonstrate the importance of participatory teaching methods and student involvement but waste prevention education still needs further development and emphasis. Most LLC students thought recycling was the best waste management strategy, suggesting that students do not understand the limitations of recycling and do not connect decreased consumption to waste prevention. This suggests that students have not achieved a systems perspective which is a critical part of waste literacy. Systems thinking is also an essential aspect of industrial ecology (IE) and it encourages the analysis of relationships among and between different parts of the system. Through a systems perspective,

IE considers the connections between environmental, social, and technological systems. ESE and IE have common goals and the LLC and other ESE programmes would benefit from a closer integration of IE. However, it should be noted that the LLC is often an introductory ESE programme, at least in Ireland and Russia, and a systems perspective takes time to form. For students to achieve a systems perspective, teachers must also understand and utilize a systems thinking approach, which likely requires additional ESE teacher training. Incorporation of ESE and systems thinking into national curriculum would ensure that teachers understand ESE principles and participatory methods before they enter the classroom.

Lastly, schools should also keep in mind that the LLC is an education programme and not a waste management system and that waste audits and environmental management systems must be utilised. Most teachers reported that the LLC had a positive effect on waste and litter levels but to know if waste goals are being achieved reliable indicator metrics are needed.

7.3 Limitations and recommendations for future research

Measuring aspects of environmental literacy is difficult and sometimes impossible as certain aspects are intangible. Additionally, it is often impossible to distinguish if the effects were due to internal motivation or an external pressure. Several factors limited the causal inference of this research. First, comparisons of LLC students to control students may be confounded because the treatment could not be isolated. Control students may have been exposed to waste and litter education through other programmes and LLC students may also be influenced through channels outside the LLC. To avoid the issue of control groups, FEE could use a pre-test and post-test design on LLC students which eliminates the need for non-LLC students. School and country variations may have also influenced student scores. Future research could focus on a specific country and specific schools to study the effects of cultural and organizational factors.

It must also be noted that surveys are not representative of an entire population; this research focused on the LLC in Ireland, Russia, and Northern Ireland but it does not fully represent LLC students

or teachers in those countries or worldwide. Additionally, the questionnaire survey method does not provide a complete picture as humans are prone to inaccurate self-reporting to achieve or maintain an ideal self-image (Brenner & DeLamater, 2016). In this case students could be answering on how they want to be perceived by their teacher or peers.

The design of both student and teacher questionnaires also came with limitations. First, both questionnaires would benefit from assigning ID numbers to teachers which students and teachers would use in their survey instead of their school's name. This would allow easier comparison of school scores and teacher factors by eliminating language differences. Some schools have more than one LLC teacher so just a school ID is not specific enough if background factors of teachers are to be analysed. The internal consistency of the knowledge portion on the student questionnaire could be improved by using similarly formatted questions. The attitude portion consistently used scales which were consistent across questions. This should also be used on the knowledge portion to improve reliability (Cronbach's alpha) and simplify analysis. The teacher questionnaire could be improved by asking teachers for critical remarks; it only asked what about the LLC worked well and all comments on the questionnaire were overwhelmingly positive. Additionally, most questions had an open response option for teachers to comment which resulted in repetitive answers across questions; this questionnaire would benefit from asking teachers to explain their teaching methods and the implementation of the LLC at their school.

ESE evaluation relies heavily on pre- and post-programme suveys and interviews, but this does not adequately assess the in-process experiences (Ardoin, Biedenweg, and O'Connor, 2015). This analysis focused on short-term outcomes, but a process or implementation evaluation would provide insight to the procedural components of the LLC. To thoroughly analyse how the LLC is influencing students' knowledge and attitude a full curriculum analysis and observational data of the programme is needed. This study used available data but to better understand the impact of the LLC alternative methods such as concept maps or focus groups are recommended for future research. Additional interviews with teachers and NOs are also recommended as only two NOs were interviewed, limiting the NO perspectives to Russia and Ireland.

Additionally, this project studied only a few factors that potentially influence attitude and knowledge; future research could study the effect of schools' socioeconomic status or teachers' level of experience on the LLC's impact. Considering this research only examined the short-term outcomes of the LLC, future research should study the long-term behavior changes of students. This would shed light on whether ESE affects long-term behavior and whether waste knowledge or attitude has a greater effect on behavior. Such research could also include investigation of the reliability and credibility of the waste and monitoring activity so that reliable observational data can be gathered in future years.

8. Conclusion

Environmental literacy and waste literacy play an important role in the field of industrial ecology as each person makes decisions which influence the actions of government and corporations which have significant influence on the sustainability of natural resources. There is a vast amount of environmental information, misinformation, and disinformation available today making ESE and waste education highly necessary. Teaching people how to make intelligent environmental decisions is part of the solution to global sustainability issues.

This study aimed to determine the effect of the LLC on students' waste literacy. Through CATPCA the student questionnaire was validated, and it did in fact measure attitude and knowledge regarding waste. This allowed scores to be made for each student and a significant difference between LLC and control students' knowledge and attitude scores was found; the null hypothesis could be rejected, and the LLC does have a significant positive effect on waste attitude and waste knowledge. This was not the case in each country, however. A significant effect was seen in Russia and Northern Ireland, but the same effect was not seen in knowledge or attitude scores in Ireland, illustrating that each country in the LLC needs to be analysed individually and that a pre- and post-test survey method may be a better assessment method. Country and school specific evaluations would allow specific programme adaptions to address local waste issues and to meet students' needs in the most effective way.

Multivariate data analysis also showed that the scores of LLC students did not depend on the gender or age of the student. In the control group gender and age showed an effect on scores: female students had higher knowledge and attitude scores compared to male students while younger students had higher attitude score compared to older students. This shows that background factors of students play a critical role in ESE, especially age. It also suggests that the LLC, and ESE generally, decreases the influence of background factors on students' waste literacy.

Overall, teachers and NOs had a positive view of the LLC and its effects on students. Through thematic analysis of interviews with NOs, student involvement was deemed the determining factor of the

LLC's impact. Further analysis of teacher comments illustrated that participatory teaching methods play a significant role in the LLC's efficacy, especially fieldwork and student ownership. Group learning methods and community events were also effective. NOs felt the flexibility of the programme also made it successful as it allowed schools to tailor the campaign to their local needs. Although it cannot be determined whether these results are solely from the influence of the LLC programme, these findings suggest that the LLC increases waste knowledge and attitudes in Russia and Northern Ireland, but it cannot be said if it increases sustainable behavior.

9. References

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes* 72(2):322–332. doi: 10.1016/0749-5978(91)90020-T.

Ajzen, I. (2001). Nature and Operation of Attitudes. *Annual Review of Psychology* 52:27–58. doi: 10.1146/annurev.psych.52.1.27. Ajzen, I. 2012. "The Theory of Planned Behavior." In *Handbook of Theories of Social Psychology*, edited by P. A. Van Lange, A. W. Kruglanski & E. T. Higgins, 438–459. London: SAGE Publications Ltd.

Ajzen, I., and M. Fishbein. (1977). Attitude - Behavior Relationships: A Theoretical Analysis and Review of the Empirical Literature." *Psychological Bulletin* 84(5):888–918. doi: 10.1037//0033-2909.84.5.888.

Alampei, I., Malotidi, V., Psallidas, V., & Scoullos, M. (2013). Key concepts in Education for Sustainable Development (ESD). In Education for Sustainable Development in Biosphere Reserves and other Designated Areas A Resource Book for Educators in South-Eastern Europe and the Mediterranean. UNESCO.

Allen, P., & Bennett, K. (2008). SPSS for the Health & Behavioural Sciences. (1st ed.) Thomson.

Al-Rawi, I. (2013). Teaching Methodology and its Effects on Quality Learning. *Journal of Education and Practice, Vol.4* (No.6). https://doi.org/article/4820

Anderson, Mark. (2012). New Ecological Paradigm (NEP) Scale. Berkshire Encyclopedia of Sustainability. 6. 260-262.

Andriamalala G., Peabody S., Gardner C.J. & Westerman K. (2013) Using social marketing to foster sustainable behaviour in traditional fishing communities of southwest Madagascar. Conservation Evidence, 10, 37-41

Anyolo, E. O., Kärkkäinen, S., & Keinonen, T. (2018). Implementing education for sustainable development in Namibia: School Teachers' perceptions and teaching practices. *Journal of Teacher Education for Sustainability*, *20*(1), 64–81. https://doi.org/10.2478/jtes-2018-0004

Ardoin, N. M., Bowers, A. W., Roth, N. W., & Holthuis, N. (2017). Environmental education and K 12 student outcomes: A review and analysis of research. *The Journal of Environmental Education*, *49*(1), 1–17. https://doi.org/10.1080/00958964.2017.1366155

Ardoin, N., Biedenweg, K., & O'Connor, K. (2015). Evaluation in Residential Environmental Education: An Applied Literature Review of Intermediary Outcomes, Applied Environmental Education & Communication, 14:1, 43-56, DOI: 10.1080/1533015X.2015.1013225

Arlinghaus, K. & Johnston, C. (2017). Advocating for behavior change with education. American Journal of Lifestyle Medicine, 12(2), 113–116. https://doi.org/10.1177/1559827617745479

Ashley, M., Pahl, S., Glegg, G., & Fletcher, S. (2019). A Change of Mind: Applying Social and Behavioral Research Methods to the Assessment of the Effectiveness of Ocean Literacy Initiatives. *Frontiers in Marine Science, 6*. doi:10.3389/fmars.2019.00288

Ballantyne, R., Packer, J., Falk, J. (2011). Visitors' learning for environmental sustainability: Testing short- and long-term impacts of wildlife tourism experiences using structural equation modelling. Tourism Management. Volume 32, Issue 6. Pages 1243-1252. ISSN 0261-5177. https://doi.org/10.1016/j.tourman.2010.11.003.

Bamberg, S., and G. Moser. (2007). Twenty Years after Hines, Hungerford and Tomera: A New Meta-Analysis of Psycho-Social Determinants of Pro-Environmental Behavior. *Journal of Environmental Psychology* 27(1):14–25. doi: 10.1016/j.jenvp.2006.12.002.

Bartl, A. (2014). Moving from recycling to waste prevention: A review of barriers and enables. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, *32*(9_suppl), 3–18. https://doi.org/10.1177/0734242x14541986

Berglund, T., Gericke, N., Chang-Rundgren, S. (2014). The Implementation of Education for Sustainable Development in Sweden: Investigating the Sustainability Consciousness among Upper Secondary Students. *Research in Science & Technological Education* 32 (3): 318–339. doi:10.1080/02635143.2014.944493.

Biasutti, M., & Frate, S. (2017). A validity and reliability study of the Attitudes toward Sustainable Development scale, Environmental Education Research, 23:2, 214-230, DOI: 10.1080/13504622.2016.1146660

Boeve-de Pauw, J. and Van Petegem, P. (2017). Eco-school Evaluation Beyond Labels: The Impact of Environmental Policy, Didactics and Nature at School on Student Outcomes. *Environmental Education Research* 24(9):1250–1267. doi:10.1080/13504622.2017.1307327.

Boeve-de Pauw, J., and Van Petegem, P. (2011). The Effect of Flemish Eco-Schools on Student Environmental Knowledge, Attitudes, and Affect. *International Journal of Science Education* 33 (11): 1513–1538. doi:10.1080/09500693.2010.540725.

Borg, C., Gericke, N., Höglund, H. O., & Bergman, E. (2014). Subject-and experience-bound differences in teachers conceptual understanding of sustainable development. Environmental Education Research, 20(4), 526n551.

Bradley, J., Waliczek, T., Zajicek, J. (1999). Relationship Between Environmental Knowledge and Environmental Attitude of High School Students. The Journal of Environmental Education. 30. 17-21. 10.1080/00958969909601873.

Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology,Qualitative Research in Psychology, 3:2, 77-101, DOI: 10.1191/1478088706qp063oa

Brennan, C., Ashley, M., & Molloy, O. (2019). A System Dynamics Approach to Increasing Ocean Literacy. *Frontiers in Marine Science, 6*. doi:10.3389/fmars.2019.00360

Brenner, P. S., and DeLamater, J. (2016). Lies, damned lies, and survey self reports? Identity as a cause of measurement bias. Soc. Psychol. Q. 79, 333–354. doi: 10.1177/0190272516628298

CEE. (n.d.). CEE Academy. https://www.ceeindia.org/cee-academy.

Chaigneau, T., & Daw, T. M. (2015). Individual and village-level effects on community support for Marine Protected Areas (MPAs) in the Philippines. *Marine Policy, 51*, 499-506. doi:10.1016/j.marpol.2014.08.007

Chan, E., Hon, A., Chan, W., & Okumus, F. (2014). What drives employees' intentions to implement green practices in hotels? The role of knowledge, awareness, concern and ecological behaviour. International Journal of Hospitality Management. 40. 20–28. 10.1016/j.ijhm.2014.03.001.

Chen, H. & Wang, N. (2014). The assignment of scores procedure for ordinal categorical data. Scientific World Journal. doi: 10.1155/2014/304213. Epub 2014 Sep 11. PMID: 25295296; PMCID: PMC4176904.

Chen, C., and Tsai, C. (2016). Marine environmental awareness among university students in Taiwan: a potential signal for sustainability of the oceans. Environ. Edu. Res. 22, 958–977. doi: 10.1080/13504622.2015.1054266

Chilvers, J., Lorenzoni, I., Terry, G., Buckley, P., Pinnegar, J. K., & Gelcich, S. (2014). Public engagement with marine climate change issues: (Re)framings, understandings and responses. *Global Environmental Change, 29*, 165-179. doi:10.1016/j.gloenvcha.2014.09.006

Cincera, J., Boeve-de Pauw, J., Goldman, D., & Simonova, P. (2019). Emancipatory or instrumental? Students' and teachers' perceptions of the implementation of the EcoSchool program. Environmental Education Research. 25:7, *1083-1104,* DOI: 10.1080/13504622.2018.1506911

Cliff, N. (1993). Dominance statistics: Ordinal Analyses to Answer Ordinal Questions. Psychological Bulletin, 114, 494-509.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd ed.)*. Hillsdale, NJ: Lawrence Earlbaum Associates.

Connell, J.P. and Kubisch, A.C. (1998) Applying a Theory of Change Approach to the Evaluation of Comprehensive Community Initiatives: Progress, Prospects, and Problems, in Karen Fulbright-Anderson et al. (eds.), *New Approaches to Evaluating Community Initiatives Vol. II: Theory, Measurement, and Analysis* (Washington, DC: The Aspen Institute)

Corney, G. (2006). Education for sustainable development: An empirical study of the tensions and challenges faced by geography student teachers. International Research in Geographical and Environmental Education, 15(3), 224n240.

Corney, G., & Reid, A. (2007). Student teachers learning about subject matter and pedagogy in education for sustainable development. Environmental Education Research, 13(1), 33ñ54.

Cottrell, S. (2003). Influence of sociodemographic and environmental attitudes of general responsible environmental behavior among recreational boaters. Environment and Behavior, 35, 347–375.

Darner, R. (2009). Self-determination theory as a guide to fostering environmental motivation. Journal of Experiential Education, 40(2), 39–49

de Winter, J. & Dodou. D. (2010). Five-Point Likert Items: t test versus Mann-Whitney-Wilcoxon, Practical Assessment, Research & Evaluation, Vol 15, No 11.

Domegan, C., Mchugh, P., Mccauley, V., & Davison, K. (2019). Co-creating a Sea Change Social Marketing Campaign for Ocean Literacy in Europe: A Digital Interactive Tool for Environmental Behavior Change. *Springer Texts in Business and Economics Social Marketing in Action,* 393-409. doi:10.1007/978-3-030-13020-6_26

Eco-Schools (2020). What is Eco-Schools? Eco-School Programme. Retrieved November 11 2020 from https://www.ecoschools.global/how-does-it-work.

Eco-schools. (n.d.). *About the Campaign*. Eco Schools. https://www.ecoschools.global/about-the-campaign.

ELL (2007). Environmental Literacy Ladder. Available online at: http://www.fundee.org/facts/envlit/whatisenvlit.htm

European Commission. (n.d). *Waste prevention and management*. Waste prevention and management - Environment - European Commission. https://ec.europa.eu/environment/green-growth/waste-prevention-and-management/index_en.htm.

Everson, J., Lee, S.-Y., & Friedman, C. (2014). Reliability and Validity of the American Hospital Association's National Longitudinal Survey of Health Information Technology Adoption. *Journal of the American Medical Informatics Association : JAMIA, 21*, e257–e263.

Farmer, J., Knapp, D., & Benton, G. (2007) An Elementary School Environmental Education Field Trip: Long-Term Effects on Ecological and Environmental Knowledge and Attitude Development, The Journal of Environmental Education, 38:3, 33-42, DOI: 10.3200/JOEE.38.3.33-42

Fauville, G., Strang, C., Cannady, M. & Chen, Y. (2019) Development of the International Ocean Literacy Survey: measuring knowledge across the world., Environmental Education Research, 25:2, 238-263, DOI: 10.1080/13504622.2018.1440381

FEE. (2020, August). Handbook for National Operators - Litter Less Campaign.

FEE. (n.d.). *Foundation for Environmental Education Foundation for Environmental Education*. https://www.fee.global/.

Fernández, D., Liu, I., Costilla, R. & Yongqi Gu, P. (2020). Assigning scores for ordered categorical responses, Journal of Applied Statistics, 47:7, 1261-1281, DOI: 10.1080/02664763.2019.1674790

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (Fifth ed.): Sage Publications.

Finch WH (2016) Comparison of Multivariate Means across Groups with Ordinal Dependent Variables: A Monte Carlo Simulation Study. Front. Appl. Math. Stat. 2:2. doi: 10.3389/fams.2016.00002

Fletcher, S., & Potts, J. (2007). Ocean Citizenship: An Emergent Geographical Concept. *Coastal Management, 35*(4), 511-524. doi:10.1080/08920750701525818

Fraser, J., Gupta, R., & Krasny, M.E. (2015). Practitioners' perspectives on the purpose of environmental education. Environmental Education Research, 21(5), 777ñ800.

Freije, A., Naser, H. & Abdulla, K. (2019) Attitudes and opinions towards public littering in the Kingdom of Bahrain. Arab Journal of Basic and Applied Sciences, 26:1, 354 361, DOI: 10.1080/25765299.2019.1628688

Gadermann, A. M., Guhn, M., & Zumbo, B. D. (2012). Estimating ordinal reliability for Likert-type and ordinal item response data: a conceptual, empirical, and practical guide. *Practical Assessment, Research & Evaluation, 17*(3).

Green, M., & Somerville, M. (2015). Sustainability education: researching practice in primary schools. Environmental Education Research, 21(6), 832ñ845.

Hallfredsdóttir, S. (2011).Eco-Schools: Are They Really Better? Comparison of Environmental Knowledge, Attitudes and Actions between Students in Environmentally Certified Schools and Traditional Schools in Iceland." Master's thesis., Reykjavik University.

Hanisch, A. (2014). How Green are European Curricula? A Comparative Analysis of Primary School Syllabi in Five European Countries. European Educational Research Journal 13(6):661 SAGE Publications Ltd 1474-9041

Hanneman, L. (2013). The Effectiveness of Experiential Environmental Education: O'Neill Sea Odyssey Program Case Study. Master's Theses. 4276. DOI: https://doi.org/10.31979/etd.vvq6-u9xr

Hartley, B. L., Pahl, S., Veiga, J., Vlachogianni, T., Vasconcelos, L., Maes, T., et al. (2018). Exploring public views on marine litter in Europe: perceived causes, consequences and pathways to change. Marine Pollut. Bull. 133, 945–955. doi: 10.1016/j.marpolbul.2018.05.061

Heidbreder, L. M., Bablok, I., Drews, S., & Menzel, C. (2019). Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *Science of The Total Environment*, *668*, 1077–1093. https://doi.org/10.1016/j.scitotenv.2019.02.437

Hill, L. H. (2005). Concept Mapping to Encourage Meaningful Student Learning. Adult Learning, 16(3–4), 7–13. https://doi.org/10.1177/104515950501600302

Hines, J. M., Hungerford, H. R., & Tomera, A. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. The Journal of Environmental Education, 18(2), 1–8.

Hof, M. (2012). Questionnaire Evaluation with Factor Analysis and Cronbach's Alpha. An example. Retrieved from http://www.let.rug.nl/nerbonne/teach/rema-stats-meth-seminar/studentpapers/MHof-QuestionnaireEvaluation-2012-Cronbach-FactAnalysis.pdf

Hungerford, H.R. & Volk, T.L. (1990) Changing Learner Behavior through Environmental Education, Journal of Environmental Education, 21(3), 8-21. http://dx.doi.org/10.1080/00958964.1990.10753743

Iliško, D., Ignatjeva, S., & Mičule, I. (2011). Teacher-Carried Research as a Tool for Teachers' Professional Growth. Journal of Teacher Education for Sustainability. 13. 10.2478/v10099-011-0016-y.

Ilse Benavides-Lahnstein, A. & Ryder, J. (2020). School teachers'conceptions of environmental education: reinterpreting a typology through a thematic analysis,Environmental Education Research, 26:1, 43-60, DOI: 10.1080/13504622.2019.1687649

Jeronen, E., Palmberg, I., & Yli-Panula, E. (2017). Teaching methods in biology education and sustainability education including outdoor education for promoting sustainability: a literature review. Educational Sciences, 7(1). doi: 10.3390/educsci 7010001.

Jurin, R. R. (1995). College students' environmental belief and value structures, and relationship of these structures to reported environmental behavior. (Doctoral dissertation, Ohio State University, 1995). Dissertation Abstracts International, 56, 2174.

Kabadayi, A. (2016). A suggested in-service training model based on Turkish preschool teachers, conceptions for sustainable development. Journal of Teacher Education for Sustainability, 18(1), 5ñ15. doi: 10.1515/jtse-2016-0001.

Kanyimba, A. T. (2002). Towards the incorporation of environmental education in the Namibian secondary school curriculum. Masters dissertation, University of South Africa.

Kimaryo, L. A. (2011). Integrating environmental education in primary school education in Tanzania: teachersí perceptions and teaching practices. Åbo, Finland: Åbo AkademiUniversity Press.

Klöckner, C. A. (2013). A comprehensive model of the psychology of environmental behaviour A meta-analysis. Global Environmental Change, 23(5), 1028-1038 doi:10.1016/j.gloenvcha.2013.05.014

Kraus, S. (1990). Attitudes and the Prediction of Behavior: A Meta-analysis. Paper presented at the annual convention of the American Psychological Association, Boston, MA, August 10–14, 1990. https://files.eric.ed.gov/fulltext/ED327751.pdf

Kraus, S. (1995). Attitudes and the Prediction of Behavior: A Meta-Analysis of the Empirical Literature. *Personality and Social Psychology Bulletin* 21(1):58–75. doi: 10.1177/0146167295211007.

Krnel, D. (2010). Environmental literacy comparison between eco-schools and ordinary schools in Slovenia. Science Education International. 20. 5-24.

Lace-Jeruma, L., Birzina, R. (2019). The Improvement of Eco-School Students' Environmental Awareness in the Context of Education for Sustainable Development. In *Rural Environment. Education. Personality.(REEP). Proceedings of the International Scientific Conference (Latvia)*. Latvia University of Life Sciences and Technologies. doi:10.22616/REEP.2019.010.

Ledesma, R., Macbeth, G. & Kohan, N. (2009). Computing Effect Size Measures with ViSta-The Visual Statistics System. Tutorials in Quantitative Methods for Psychology. 5. 10.20982/tqmp.05.1.p025.

Liang, S., Fang, W., Yeh, S., Liu, S.,Tsai, H., Chou, J., & Ng, E. (2018). A Nationwide Survey Evaluating the Environmental Literacy of Undergraduate Students in Taiwan. Sustainability. 10. 1730. 10.3390/su10061730.

Linting, M. & van der Kooij, A. (2012) Nonlinear Principal Components Analysis With CATPCA: A Tutorial, Journal of Personality Assessment, 94:1, 12-25, DOI: 10.1080/00223891.2011.627965

Linting, M., Meulman, J. J., Groenen, P. J. F., & Van der Kooij, A. J. (2007). Stability of nonlinear principal components analysis: An empirical study using the balanced bootstrap. *Psychological Methods, 12*, 359–379.

Littledyke, M. (2008). Science education for environmental awareness: Approaches to integrating cognitive and affective domains. Environmental Education Research,14(1), 117.

Lund Research. (2018). *Assumptions of the mann-whitney u test*. Assumptions of the Mann-Whitney U test | Laerd Statistics. https://statistics.laerd.com/statistical-guides/mann-whitney-u-test-assumptions.php.

Lund Research. (2018b). *Two-way MANOVA in SPSS Statistics*. How to perform a two-way MANOVA in SPSS Statistics | Laerd Statistics. https://statistics.laerd.com/spss-tutorials/two-way-manova-using-spss-statistics.php.

Macbeth, G., Razumiejczyk, E., Ledesma, R. (2011). Daniel Cliff's Delta Calculator: A non-parametric effect size program for two groups of observations Universitas Psychologica, vol. 10, núm. 2. Pontificia Universidad Javeriana Bogotá, Colombia.

Marcinkowski, T. & Reid, A. (2019). Reviews of Research on the Attitude-Behavior Relationship and Their Implications for Future Environmental Education Research. *Environmental Education Research* 25 (4): 459–471. doi:10.1080/13504622.2019.1634237.

Mcbride, B. B., Brewer, C. A., Berkowitz, A. R., Borrie, W. T. (2013). Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? Ecosphere, 4(5). doi:10.1890/es13-00075.1

McMillan, E., Wright, T., Beazley, K. (2004). Impact of a University-Level Environmental Studies Class on Students' Values. The Journal of Environmental Education. 35. 19-27. 10.3200/JOEE.35.3.19-27.

Monroe, M. (2010). Challenges for environmental education evaluation. Evaluation and Program Planning, 33, 194-196. ISSN 0149-7189, https://doi.org/10.1016/j.evalprogplan.2009.07.012.

Mostafa, M. (2009). Shades of green: a psychographic segmentation of the green consumer in Kuwait using self-organizing maps. Journal of Expert Systems with Applications, Vol. 36 No. 8, pp. 11030-11038.

Muderrisoglu, H., and Altanlar, A. (2011). Attitudes and behaviors of undergraduate students toward environmental issues. Int. J. Environ. Sci. Technol. 8, 159–168. doi: 10.1007/BF03326205

Mweti, I., & van Wyk, H. (2005). NSSC Development Studies. Module 2. Cambridge: Cambridge University Press.

Navas González, F. J., Jordana Vidal, J., Pizarro Inostroza, G., Arando Arbulu, A., & Delgado Bermejo, J. V. (2018). Can Donkey Behavior and Cognition Be Used to Trace Back, Explain, or Forecast Moon Cycle and Weather Events? *Animals : an open access journal from MDPI, 8*(11), 215. doi:10.3390/ani8110215

Olsson, D., Gericke, N., Boeve-de Pauw, J., Berglund, T., and Chang., T (2019). Green Schools in Taiwan–Effects on Student Sustainability Consciousness. *Global Environmental Change* 54: 184–194. doi:10.1016/j.gloenvcha.2018.11.011.

Olsson, D., Gericke, N., Chang-Rundgren, S. (2016). The Effect of Implementation of Education for Sustainable Development in Swedish Compulsory Schools–Assessing Pupils' Sustainability Consciousness. *Environmental Education Research* 22 (2): 176–202. doi:10.1080/13504622.2015.1005057.

Osbaldiston, R., & Sheldon, K. M. (2003). Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals. Journal of Environmental Psychology, 23, 349–357.

Pahl, S., and K.J. Wyles. (2017). The Human Dimension: How Social and Behavioural Research Methods Can Help Address Microplastics in the Environment. Analytical Methods 9: 1404–11.

Pe'er, S., Goldman, D., & Yavetz, B. (2007) Environmental Literacy in Teacher Training: Attitudes, Knowledge, and Environmental Behavior of Beginning Students. The Journal of Environmental Education, 39:1, 45-59, DOI: 10.3200/JOEE.39.1.45-59

Sauvé, L. (2005). Currents in Environmental Education: Mapping a Complex and Evolving. Canadian Journal of Environmental Education. 10. https://files.eric.ed.gov/fulltext/EJ881772.pdf

Saypanya, S., Hansel, T., Johnson, A., Bianchessi A., and Sadowsky B. (2013). Effectiveness of a social marketing strategy, coupled with law enforcement, to conserve tigers and their prey in Nam Et Phou Louey National Protected Area, Lao People's Democratic Republic. Conserv. Evid. 10, 57–66.

Schoedinger, S. & Cava, F. & Strang, C. & Tuddenham, Peter. (2005). Ocean literacy through science standards. 736 - 740 Vol. 1. 10.1109/OCEANS.2005.1639840.

Schwartz, S. H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), Advances in experimental social psychology, (Vol. 10, pp. 221–279). New York: Academic Press.

Spinola, H. (2015). Environmental literacy comparison between students taught in Eco-schools and ordinary schools in the Madeira Island region of Portugal. Science Education International. 26. 392-413.

Spiropoulou, D., Antonakaki, T., Kontaxaki, S., & Bouras, S. (2007). Primary teachers illiteracy and attitudes on education for sustainable development. Journal of and Technology, 16, 443ñ450. doi: 10.1007/s10956-007-9061-7.

Srnka, K. J., & Koeszegi, S. T. (2007). From words to numbers: How to transform qualitative data into meaningful quantitative results. *Schmalenbach Business Review*, *59*(1), 29–57. https://doi.org/10.1007/bf03396741

Stevens, J.P. (1996). Applied Multivariate Statistics for the Social Sciences. Mahwah, NJ: Lawrence Erlbaum and Associates, Publishers.

Stevenson K., Peterson M., Bondell H., Mertig A., Moore S. (2013). Environmental, Institutional, and Demographic Predictors of Environmental Literacy among Middle School Children. PLoS ONE 8(3): e59519. https://doi.org/10.1371/journal.pone.0059519

Summers, M., Childs, A., & Corney, G. (2005). Education for sustainable development in initial teacher training: Issues for interdisciplinary collaboration. Environmental Education Research, 11(5), 623ñ647.

Sund, L. (2016). Facing global sustainability issues: Teachers experiences of their own practices in environmental and sustainability education. Environmental Education Research, 22(6), 788n805.

Timmerman, M. E., Kiers, H. A. L., & Smilde, A. K. (2007). Estimating confidence intervals for principal component loadings: A comparison between the bootstrap and asymptotic results. *British Journal of Mathematical and Statistical Psychology, 60*, 295–314.

Tucker, P. & Douglas, P. (2006). *Understanding Household Waste Prevention Behaviour, Technical Report No. 1: A Critical Review of the Literature*.

Tudor, T., Barr, S., and Gilg, A.. (2008). A novel conceptual framework for examining environmental behavior in large organizations a case study of the Cornwall National Health Service (NHS) in the United Kingdom. Environment and behavior, Vol. 40 No. 3, pp. 426-450.

Uitto, A., & Saloranta, S. (2017). Subject teachers as educators for sustainability: A survey study. Education Sciences, 7(8). doi: 10.3390/educsci7010008.

Uneputty, P., Evans, S. & Suyoso, E. (1998). The effectiveness of a community education programme in reducing litter pollution on shores of Ambon Bay (eastern Indonesia), Journal of Biological Education, 32:2, 143-147, DOI: 10.1080/00219266.1998.9655611

UNESCO-UNEP (1976). "The Belgrade Charter". Connect: UNESCO-UNEP Environmental Newsletter, Vol. 1 (1) pp. 1-2.

UNESCO-UNEP. (1978). Final Report Intergovernmental Conference on Environmental Education. Organized by UNESCO in Cooperation with UNEP, Tbilisi, USSR, 14-26 October 1997, Paris: UNESCO.

University of Tasmania. (2021, June 7). *Examples of learning activities*. Teaching & Learning. Retrieved October 14, 2021, from https://www.teaching-learning.utas.edu.au/learning-activities-and-delivery-modes/planning-learning-activities/examples-of-learning-activities.

Vargha, A. and H.D. Delaney. A Critique and Improvement of the CL Common Language Effect Size Statistics of McGraw and Wong. 2000. Journal of Educational and Behavioral Statistics 25(2):101–132.

Wallace, D., Paulson, M., Lord, C., Bond, C. (2005). Which Behaviors Do Attitudes Predict? Meta-Analyzing the Effects of Social Pressure and Perceived Difficulty. *Review of General Psychology* 9(3):214–227. doi: 10.1037/1089-2680.9.3.214.

Willis, K., Maureaud, C., Wilcox, C., & Hardesty, B. D. (2018). How successful are waste abatement campaigns and government policies at reducing plastic waste into the marine environment? *Marine Policy*, *96*, 243–249. https://doi.org/10.1016/j.marpol.2017.11.037

Yin, R. K. (2012). Applications of case study research (3rd Ed.) Thousand Oaks: Sage.

Zsóka, Á., Szerényi, Z., Széchy, A., & Kocsis, T. (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. Journal of Cleaner Production. 48. 126–138. 10.1016/j.jclepro.2012.11.030.

10. Appendix

Appendix A: Lesson Plan Sample

Understanding Packaging

Lesson 1 Plan

INTRODUCTION

The product packaging often has information about the content, price and quantity of the product, make it convenient to store and use the product and also tell us where the product was manufactured and how and by when it should be utilised. Packaging sometimes has important symbols like the recycling symbol, ingredients source (vegetarian and non vegetarian), hazards etc.

The lesson plan encourages students to understand packaging, its relevance and purpose and also the impacts packaging waste is creating on the environment.

Objectives:

Students will be able to

- identify different types of packaging material used for household products.
- list different types of packaging material available in the market.
- visualise different types of packaging material and sort these into different categories.

Eco-Schools Steps: Audit, Action Plan development, Evaluation and Monitoring, Inform and Involve

Curriculum Linkage: Science/ Environmental Studies/Social Science/ Numeracy and Mathematics

Eco-Schools

6-8 Years

Time required/ Duration:

- **Classroom session 1:** 45 minutes for the teacher to do a background introduction on packaging and for the colouring and circling activity.
- **Home assignment 1:** Four hours over a week for completing the packaging worksheet and to collect and bring back to their classrooms different types of packaging material.
- **Classroom session 2:** 90 minutes provided to students to develop a "display on packaging material".

Resources Required:

- Resource Sheet 1 for identifying human-made packaging and packaging in nature
- Resource sheet 2 : Worksheet for listing different types of packaging material available in the market
- Different packaging material collected by students or teachers
- Dedicated display board
- Student's stationery including colouring material (crayons/ colour pencils/ others)

4 QUALITY EDUCATION

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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Activity

Classroom session 1

- Start with a discussion introducing students to packaging. To get students to understand "packaging", it will be useful to ask probing/ leading questions to students and work further based on the response received.
    1. What packaging is?
    2. What is the importance of packaging?
    3. What are the problems caused by different types of packaging?
- Hand over the colouring sheet on human-made packaging and packaging in nature to the students.
- Ask the sudents to colour objects which represent packaging in nature and circle those which represent human made packaging.

Home Assignment 1

- Ask the students to fill a worksheet on different packaging material based on the home survey.
- Collect some of these packaging material and bring it back to class along with the filled in worksheets. These packaging material will be required for Classroom session 2.
- Instruct students to fill in Resource 2 (Worksheet for Packaging material), based on the products which were purchased and brought home during the course of the home assignment.

Classroom session 2

- Review and discuss the worksheets completed by students.
- Ask the students to sort the representative packaging material brought back by students based on waste types (natural or human-made, which should be further categorised into paper based, metal, glass, etc.) and a Eco-Schools display board on packaging material should be developed by students.
- This board should be maintained for A month and will help to inform and involve students.

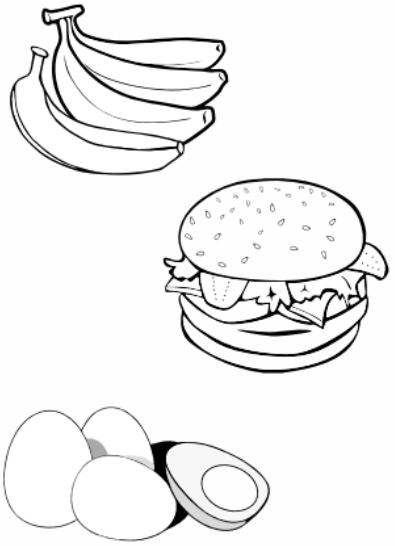
Evaluation:

Colouring the right objects will help teachers ascertain whether the students have understood natural and human-made packaging material.

Sorting of packaging material for the display boards will be a good way to assess whether students have understood the concept.

Resource 1

Colouring Sheet



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Resource 2

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Appendix B: Student and Teacher Questionnaires

Question Versions by Year and Program

No.	Question	ES 2019	YRE 2019	ES 2020	YRE 2020	ES 2021	YRE 2021
1	How important do you think it is that people reduce the amount of waste they produce at home?	Likert scale: 5 = Very important , 1 = Not important	Likert scale: 5 = Very important , 1 = Not important	Likert scale: 5 = Very important , 1 = Not important	Likert scale: 5 = Very important , 1 = Not important	Likert scale: 5 = Very important , 1 = Not important	Likert scale: 5 = Very important , 1 = Not important
	Participating countries	Ireland, Wales, Russia, Mexico, Kenya, India	Malta, Wales, Northern Ireland, Israel, New Zealand, India	Ireland, Spain, Russia, China, Kenya, Australia	France, Northern Ireland, New Zealand, China, India	Ireland, Russia, Spain	France, Northern Ireland
2	There are different ways to reduce the harmful effects of waste on the environment. How would you rank their importance? (5 = most important and 1 = least important)	Preventing waste	Preventing waste	Preventing waste	Preventing waste	Stop buying things you don't really need	Stop buying things you don't really need
		Re-using waste	Re-using waste	Re-using waste	Re-using waste	Re-using products instead of discarding them as waste	Re-using products instead of discarding them as waste
		Disposing waste in a landfill	Disposing waste in a landfill	Disposing waste in a landfill	Disposing waste in a landfill	Disposing waste in a landfill	Disposing waste in a landfill
		Recycling waste	Recycling waste				
		Composting organic waste	Composting organic waste				
				Recycling and Composting	Recycling and Composting	Recycling and composting	Recycling and composting
						Burning waste to produce energy	Burning waste to produce energy
	Participating countries	Ireland, Wales, Russia, Mexico, Kenya, India	Malta, Wales, Northern Ireland, Israel, New Zealand, India	Ireland, Spain, Russia, China, Kenya, Australia	France, Northern Ireland, New Zealand, China, India	Ireland, Russia, Spain	France, Northern Ireland
3	Below is a list of topics. Please mark how much you know about them.	Recycling	Recycling	Recycling	Recycling	Recycling	Recycling
		Composting	Composting	Composting	Composting	Composting	Composting
		Incineration	Incineration	Incineration	Incineration	Incineration	Incineration
		Landfill	Landfill	Landfill	Landfill	Landfill	Landfill
		Segregation/Waste separation	Segregation/Waste separation	Waste sorting	Waste sorting	Waste sorting	Waste sorting
				Decomposition	Decomposition	Decomposition	Decomposition
				Sustainability	Sustainability	Sustainability	Sustainability
	Participating countries	Ireland, Wales, Russia, Mexico, Kenya, India	Malta, Wales, Northern Ireland, Israel, New Zealand, India	Ireland, Spain, Russia, China, Kenya, Australia	France, Northern Ireland, New Zealand, China, India	Ireland, Russia, Spain	France, Northern Ireland
4	Q8.A list of materials and items is provided below. Please tick the boxes next to the ones that can be recycled.	Glass	Glass	Glass	Glass	Glass	Glass
		Plastic	Plastic	Plastic	Plastic	Plastic	Plastic
		Tins and cans	Tins and cans	Tins and cans	Tins and cans	Tins and cans	Tins and cans
		Clothes	Clothes	Clothes	Clothes	Clothes	Clothes
		Paper	Paper	Paper	Paper	Paper	Paper
		Garden waste	Garden waste	Garden waste	Garden waste	Garden waste	Garden waste
					Mobile phones	Mobile phones	Mobile phones
	Participating countries	Ireland, Wales, Russia, Mexico, Kenya, India	Malta, Wales, Northern Ireland, Israel, New Zealand, India	Ireland, Spain, Russia, China, Kenya, Australia	France, Northern Ireland, New Zealand, China, India	Ireland, Russia, Spain	France, Northern Ireland
5	How often do you : (5 = Very often, 1 = Never)	Pick up litter lying around in the school	Pick up litter lying around in the school	Pick up litter lying around in the school	Pick up litter lying around in the school		
						Feel bothered by litter you see lying around	Feel bothered by litter you see lying around
		Keep a food wrapper with you until you find a waste bin	Keep a food wrapper with you until you find a waste bin	Keep a food wrapper with you until you find a waste bin	Keep a food wrapper with you until you find a waste bin	Keep a food wrapper with you until you find a waste bin	Keep a food wrapper with you until you find a waste bin
		Talk to friends and family about waste	Talk to friends and family about waste	Talk to your family about waste	Talk to your family about waste	Talk to your family about waste	Talk to your family about waste
		Ask people not to litter	Ask people not to litter				
		Use both sides of paper for writing or drawing		Use both sides of paper for writing or drawing	Use both sides of paper for writing or drawing	Use both sides of paper for writing or drawing	Use both sides of paper for writing or drawing
		Segregate waste		Sort waste into different bins	Sort waste into different bins	Sort waste into different bins	Sort waste into different bins
		Re-use things instead of buying new		Re-use things instead of buying new	Re-use things instead of buying new	Re-use things instead of buying new	Re-use things instead of buying new
	Participating countries	Ireland, Wales, Russia, Mexico, Kenya, India	Malta, Wales, Northern Ireland, Isr	Ireland, Spain, Russia, China, Kenya, Australia	France, Northern Ireland, New Zealand, India	Ireland, Russia, Spain	France, Northern Ireland
6	If you saw your friend throwing a food wrapper in the school yard, what would you do? (You can tick more than one box).	Ask him or her to pick it up and throw it into a waste bin	Ask him or her to pick it up and throw it into a waste bin	Ask him or her to pick it up and throw it into a waste bin	Ask him or her to pick it up and throw it into a waste bin	Ask him to pick it up and throw it into a waste bin	Ask him to pick it up and throw it into a waste bin
		Pick it up yourself and throw it into a waste bin	Pick it up yourself and throw it into a waste bin	Pick it up yourself and throw it into a waste bin	Pick it up yourself and throw it into a waste bin	Pick it up yourself and throw it into a waste bin	Pick it up yourself and throw it into a waste bin
		Ignore it since it will be picked up by the cleaner anyway	Ignore it since it will be picked up by the cleaner anyway	Ignore it since it will be picked up by the cleaner anyway	Ignore it since it will be picked up by the cleaner anyway	Ignore it since it will be picked up by the cleaner anyway	Ignore it since it will be picked up by the cleaner anyway
		Tell a teacher	Tell a teacher	Tell a teacher about it	Tell a teacher about it		
		Other (please specify)	Other (please specify)	Other (please specify)	Other (please specify)		
						Tell him it is not ok to litter	Tell him it is not ok to litter
						Tell your teacher that it might be useful to talk about littering during class	Tell your teacher that it might be useful to talk about littering during class
	Participating countries	Ireland, Wales, Russia, Mexico, Kenya, India	Malta, Wales, Northern Ireland, Israel, New Zealand, India	Ireland, Spain, Russia, China, Kenya, Australia	France, Northern Ireland, New Zealand, China, India	Ireland, Russia, Spain	France, Northern Ireland

7	Q13.How long do you think it can take for a plastic bottle to break down in nature?	NA	NA	Q13.How long do you think it can take for a plastic bottle to break down in nature?	Q13.How long do you think it can take for a plastic bottle to break down in nature?	Q13.How long do you think it can take for a plastic bottle to break down in nature?	Q13.How long do you think it can take for a plastic bottle to break down in nature?
	Participating countries			Spain, Kenya, China, Australia	Northern Ireland, New Zealand, China, India	Spain	Northern Ireland
8	Q14.How often do you do the following?	NA	NA	Use a lunch box for your food Use a reusable water bottle Avoid packing your food in a plastic bag	Use a lunch box for your food Use a reusable water bottle Avoid packing your food in a plastic bag	Use a lunch box for your food Use a reusable water bottle Avoid packing your food in a plastic bag	Use a lunch box for your food Use a reusable water bottle Avoid packing your food in a plastic bag
	Participating countries			Ireland, Spain, Russia, China, Kenya, Australia	Northern Ireland, New Zealand, China, India	Ireland, Russia, Spain	Northern Ireland
9	Q15.Which of the following words come to your mind when you think about packaging? (Please choose three)	NA	NA	Freshness Information Environment Transportation Impression Storage Waste Durability Nutrition Ingredients Quantity Expiration date Material Size Pollution	Freshness Information Environment Transportation Impression Storage Waste Durability Nutrition Ingredients Quantity Expiration date Material Size Pollution	Freshness Information Environment Transportation Impression Storage Waste Durability Nutrition Ingredients Quantity Expiration date Material Size Pollution	Freshness Information Environment Transportation Impression Storage Waste Durability Nutrition Ingredients Quantity Expiration date Material Size Pollution
	Participating countries			Ireland, Russia, Kenya	France, New Zealand, India	Ireland, Russia	France
10	Q17.How often would you:	NA	NA	Buy products with less or no packaging Buy products with packages that are bio- degradable Avoid asking for plastic bags when you shop	Buy products with less or no packaging Buy products with packages that are bio- degradable Avoid asking for plastic bags when you shop	Buy products with less or no packaging Buy products with packages that are bio- degradable Avoid asking for plastic bags when you shop	Buy products with less or no packaging Buy products with packages that are bio- degradable Avoid asking for plastic bags when you shop
	Participating countries			Spain, Kenya	France, New Zealand, India	Spain	France
11	Q17.Before you buy or receive new things	NA	NA	Consider whether you really need it Consider whether you can use something else instead Consider whether the people making the product are happy with their job Consider whether the production of the product harmed the environment Consider whether the transport of the product harmed the environment Decide to have it without caring about other's opinion	Consider whether you really need it Consider whether you can use something else instead Consider whether the people making the product are happy with their job Consider whether the production of the product harmed the environment Consider whether the transport of the product harmed the environment Decide to have it without caring about other's opinion	Consider whether you really need it Consider whether you can use something else instead Consider whether the people making the product are happy with their job Consider whether the production of the product harmed the environment Consider whether the transport of the product harmed the environment Decide to have it without caring about other's opinion	Consider whether you really need it Consider whether you can use something else instead Consider whether the people making the product are happy with their job Consider whether the production of the product harmed the environment Consider whether the transport of the product harmed the environment Decide to have it without caring about other's opinion
	Participating countries			Spain	India	Spain	NA
12	Q18.Please tick what you know is true or false regarding hazardous waste:	NA	NA	Hazardous waste is waste that can explode or ignite Hazardous waste is waste that can be toxic Hazardous waste can only be found as liquid Hazardous waste is not harmful for the environment Hazardous waste in nature can accumulate in the food chain Exposure to hazardous waste can be unhealthy	Hazardous waste is waste that can explode or ignite Hazardous waste is waste that can be toxic Hazardous waste can only be found as liquid Hazardous waste is not harmful for the environment Hazardous waste in nature can accumulate in the food chain Exposure to hazardous waste can be unhealthy	Hazardous waste is waste that can explode or ignite Hazardous waste is waste that can be toxic Hazardous waste can only be found as liquid Hazardous waste is not harmful for the environment Hazardous waste in nature can accumulate in the food chain Exposure to hazardous waste can be unhealthy	Hazardous waste is waste that can explode or ignite Hazardous waste is waste that can be toxic Hazardous waste can only be found as liquid Hazardous waste is not harmful for the environment Hazardous waste in nature can accumulate in the food chain Exposure to hazardous waste can be unhealthy
	Participating countries			Russia	India	Russia	NA
13	Q19.Ideally, how should used batteries be disposed? (You can tick more than one box)	NA	NA	Throw it in a bin for regular household waste Throw it in a bin for hazardous waste Deliver them at a hazardous waste collection point Deliver them back to the shop where they were bought Throw it in a bin for plastic waste	Throw it in a bin for regular household waste Throw it in a bin for hazardous waste Deliver them at a hazardous waste collection point Deliver them back to the shop where they were bought Throw it in a bin for plastic waste	Throw it in a bin for regular household waste Throw it in a bin for hazardous waste Deliver them at a hazardous waste collection point Deliver them back to the shop where they were bought Throw it in a bin for plastic waste	Throw it in a bin for regular household waste Throw it in a bin for hazardous waste Deliver them at a hazardous waste collection point Deliver them back to the shop where they were bought Throw it in a bin for plastic waste
	Participating countries			Russia	India	Russia	NA
14	Please indicate your level of knowledge about the following topics:	NA	NA	Ocean gyres The Great Pacific Garbage Patch Micro plastic beads Bio-accumulation Avoid using plastic straws and plastic bags when you go to the beach	Ocean gyres The Great Pacific Garbage Patch Micro plastic beads Bio-accumulation Avoid using plastic straws and plastic bags when you go to the beach	Ocean gyres The Great Pacific Garbage Patch Micro plastic beads Bio-accumulation Avoid using plastic straws and plastic bags when you go to the beach	Ocean gyres The Great Pacific Garbage Patch Micro plastic beads Bio-accumulation Avoid using plastic straws and plastic bags when you go to the beach
	Participating countries			Australia	Northern Ireland, India	NA	Northern Ireland
15	If you think about marine litter, how often would you be willing to:	NA	NA	Pick up litter you see on the beach or in the water Avoid using single-use plastic cups and utensils when you go to the beach Keep your waste with you until you find a waste bin	Pick up litter you see on the beach or in the water Avoid using single-use plastic cups and utensils when you go to the beach Keep your waste with you until you find a waste bin	Pick up litter you see on the beach or in the water Avoid using single-use plastic cups and utensils when you go to the beach Keep your waste with you until you find a waste bin	Pick up litter you see on the beach or in the water Avoid using single-use plastic cups and utensils when you go to the beach Keep your waste with you until you find a waste bin
	Participating countries			Australia	Northern Ireland, India	NA	Northern Ireland

Table A.1. Question versions from 2019-2021 questionnaires and countries that participated.

Question	Subquestions	Answer options
Q8.Have you previously implemented environmental campaigns/programmes?	No other programs	Select all that apply
	LEAF	
	YRE	
	Other programmes/campaigns	Free response.
Q9.To what degree:	degree of integration of environmental subjects in school curriculum	High, medium, low
	degree of implemention of environmental campaigns/programmes	
	degree of student involvement in outdoor activities during school time	
	Comments	Comment
Q10.Did your students do any of the following as part of the Litter Less Campaign during this school year?	Carry out an environmental review about litter and waste	Select all that apply.
	Raise specific litter and waste issues with the school's eco-committee	
	Create an action plan to resolve or improve the issues	
	Monitor and evaluate whether the issues were improved or resolved	
	Inform others about their efforts to resolve the issues	
	Produce an eco-code that addresses littering and responsible waste management	
	Other (Please specify)	Free response.
Q11.Did your students become familiar with the following terms during the campaign?	Recycling	Select all that apply.
	Composting organic waste	
	Incineration	
	Landfill	
	Segregation/Waste sorting	
	Decomposition	
	Sustainability	
	Re-use of waste	
	Waste prevention	
	Other (please specify)	Free response.
Q12.Which of the following were the main topics covered during your teaching of litter and waste?	Plastic pollution	Select all that apply.
	Packaging	
	Responsible consumption	
	Hazardous waste	
	Marine pollution	
	Electronic waste	
	Organic waste	
	Other (please specify)	Free response.

Q13.Please rate the impact of the Litter Less activities on your students from:	They became conscious of their own behaviour	1 (Low impact) to 5 (High impact
	They became aware of the negative effects of littering and waste production on the environment	
	They encouraged friends and family to change behaviour	
	The school and/or the local area are cleaner	
	Other (please specify)	Free response.
Q14.Please rate how likely is it in your opinion that your students:	Would pick up litter they see lying around in the school	1 (unlikely),5 (highly likely)
	Will approach other students they see littering and ask them to pick it up	
	Report a student they see littering	
Q15.Would you like to be provided with any of the following teaching material, to aid you with teaching about litter and waste? (	Videos	Select all that apply.
	Text material	
	Ideas for experiments	
	Ideas for outdoor lessons	
	Links	
	Pictures	
	PowerPoint templates	
	PowerPoint drawing templates	
	Leaflets	
	Lesson plans	
	Webinars	
	No, thanks	
	Other (please specify)	Free response.

Q16.Please indicate the Litter Less resources/materials that you used in your teaching and their relevance?	Guidelines for Monitoring of Litter and Waste in School	
	Litter Less Lesson Plans	
	Litter Less website	
	The webinars on Circular Economy, Project Based Learning, Fostering Civic Participation and more	
	Litter Less Home Challenge	
	Comments	Free response.
Q17.Did you watch the Litter Less introduction video? Please rate how the video helped you with :	Yes/No	High, medium, low
	Q17.Understanding the purpose of the Litter Less Campaign	
	Q17.Planning how to implement the campaign following the '7-step process' of the Eco-Schools programme	
	Q17.Knowing the set of skills your students develop during the campaign	
	Q17.Planning how to apply what you've learned from the video into your work	
	Q17.Knowing where you can get further information/inspiration about the Litter Less Campaign	
	Q17.Finding how to integrate the campaign with your school's curriculum	
	Q17.Understanding how the Litter Less Campaign is evaluated	
	Any comments about the content, duration, techniques, etc.?	Free response.
Q18.Which elements in the Litter Less Campaign worked well?		Free response.
Q19.Have you ever recommended the Litter Less Campaign to a colleague from another school?		Yes or no.

Table A.2. ES teacher questionnaire.

Q18.Please indicate the Litter Less resources/materials that you used in your YRE-teaching and their relevance?	Litter Less YRE Handbook	High, medium, low
	Litter Less Lesson Plans	
	YRE Website	
	The video tutorials on how to make articles, photos and videos	
	The webinars on Circular Economy, Project Based Learning, Fostering Civic Participation and more	
	Any comments?	Free response.
Q19.Did you attend a YRE Litter Less teacher training workshop?		Yes/no.
Please rate to what degree the workshop helped you with :	Q19. Understanding the purpose of the Litter Less Campaign	High, medium, low
	Q19. Describing the '4-step process' of the YRE programme	
	Q19. Knowing the set of skills your students develop during the campaign	
	Q19. Planning how to apply what you've learned from the workshop into your YRE work	
	Q19. Knowing where you can get further information/inspiration about the Litter Less Campaign	
	Q19.Finding how to integrate the campaign with your school's curriculum	
	Q19. Understanding how the Litter Less Campaign is assessed	
	Q19. Any comments about the content, duration, techniques, venue, etc.?	Free response.
Q20.Which elements in the Litter Less Campaign worked well?		Free response.
Q21.Have you ever recommended the Litter Less Campaign to a colleague from another school?		Yes/no.

Question	Subquestions	Answer options
Q8.Have you previously implemented environmental campaigns/programmes?	No other programs	Select all that apply
	LEAF	
	YRE	
	Other programmes/campaigns	Free response.
Q9.To what degree:	degree of integration of environmental subjects in school curriculum	High, medium, low
	degree of implemention of environmental campaigns/programmes	
	degree of student involvement in outdoor activities during school time	
	Comments	Comment
Q10.Did your YRE-students do any of the following as part of the Litter Less Campaign during this school year? (You can tick multiple boxes)	Investigate a local environmental issue	Select all that apply.
	Research solutions to a local environmental issue	
	Report on a local environmental issue	
	Share their work with a local audience	
	Present their projects in Community Action Days	
	Exchange experience with students from other school/s	
	Other (Please specify)	Free response.
Q11.Did your students become familiar with the following terms during the campaign? (You can tick more than one)	Recycling	Select all that apply.
	Composting organic waste	
	Incineration	
	Landfill	
	Segregation/Waste sorting	
	Decomposition	
	Sustainability	
	Re-use of waste	
	Waste prevention	
	Other (please specify)	Free response.
Q12.Which of the following were the main topics covered during your teaching of litter and waste? (You can tick more than one box)	Plastic pollution	Select all that apply.
	Packaging	
	Responsible consumption	
	Hazardous waste	
	Marine pollution	
	Electronic waste	
	Organic waste	
	Other (please specify)	Free response.
Q13.Please rate the impact of your students' projects from 1 (Low impact) to 5 (High impact):	They became conscious of their own behaviour	1 (Low impact) to 5 (High impact
	They raised awareness about the issues investigated	
	They encouraged others to act or to change behaviour	
	The problem was resolved	
	Other (please specify)	Free response.

Q14.Please rate how likely is it in your opinion that your students:	Would pick up litter they see lying around in the school	1 (unlikely),5 (highly likely)
	Will approach other students they see littering and ask them to pick it up	
	Report a student they see littering	
	Contact the local authorities to report on a waste problem	
	Will mobilize family and friends to solve a littering incident in their community	
Q15.Which of the following skills have your students acquired during the campaign? (You can tick multiple boxes)	The ability to identify a local waste issue	Select all that apply.
	The ability to analyze a waste issue	
	The ability to collect information from various sources	
	The ability to critically evaluate information	
	The ability to explore solutions for a specific environmental issue	
	The ability to produce an article, photo or video about an environmental issue	
	The ability to describe their work to others	
	The ability to defend their point of view using the information collected	
	The ability to learn from the experience of others	
	Other (please specify)	Free response.
Q16.Which step in the '4-step process' has been most difficult for the students? (Please tick one only)The '4-step process' entails learning by following the 4 steps of 1) investigation 2) proposal of solution 3) reporting and 4) dissemination.	Investigating a local environmental issue	Select one.
	Researching solutions to a local environmental issue	
	Reporting on a local environmental issue	
	Sharing the work with a local audience	
	I do not follow the '4-step process' in my YRE teaching	
	Any comments?	
Q17.Would you like to be provided with any of the following types of teaching material, to aid you with teaching YRE-students about litter and waste? (You can tick multiple boxes)	Tutorials related to filming and film-editing	Select all that apply.
	Tutorials related to writing an article	
	Tutorials related to photography and photo-editing	
	Lesson plans	
	Webinars	
	No, thanks	
	Other (please specify)	Free response.

Table A.3. YRE teacher questionnaire.

Appendix C: SPSS Syntax

***Renaming background variables**

```
RECODE Treatment ('Control'='1') ('LLC'='2').
EXECUTE.

RECODE Programme ('ES'='1') ('Es'='1') ('YRE'='2').
EXECUTE.

RECODE Country ('Ireland'='1') ('Russia'='2') ('Northern Ireland'='3').
EXECUTE.
```

***Scoring student reponses**

***Q1 Total score**

```
COMPUTE Q1TotalScore=(Q1.ReducingWasteAtHome).
EXECUTE.
```

***Q2 total score - 5 points possible**

```
RECODE Q2.StopBuyingThings (5=1) (1 thru 4=0) INTO Q2.StopBuyingThingsR.
VARIABLE LABELS  Q2.StopBuyingThingsR 'Q2. Preventing Waste Recoded'.
EXECUTE.

RECODE Q2.ReusingProducts (4=1) (5=0) (1 thru 3=0) INTO Q2.ReusingProductsR.
VARIABLE LABELS  Q2.ReusingProductsR 'Q2. Reusing products Recoded'.
EXECUTE.

RECODE Q2.RecyclingAndComposting (3=1) (1 thru 2=0) (4 thru 5=0) INTO
Q2.RecyclingAndCompostingR.
VARIABLE LABELS  Q2.RecyclingAndCompostingR 'Q2. Recycling and Composting Recoded'.
EXECUTE.

RECODE Q2.BurningForEnergy (2=1) (1=0) (3 thru 5=0) INTO Q2.BurningForEnergyR.
VARIABLE LABELS  Q2.BurningForEnergy 'Q2.Burning For Energy Recoded'.
EXECUTE.

RECODE Q2.Landfill (1=1) (2 thru 5=0) INTO Q2.LandfillR.
VARIABLE LABELS  Q2.LandfillR 'Q2. Landfill Recoded'.
EXECUTE.

COMPUTE Q2TotalScore=Q2.StopBuyingThingsR + Q2.BurningForEnergyR + Q2.ReusingProductsR +
Q2.RecyclingAndCompostingR +  Q2.LandfillR.
EXECUTE.
```

***Q2 total score for CATPCA - no zeros**

```
COMPUTE Q2TotalScorePCA=Q2.StopBuyingThingsPCA + Q2.BurningForEnergyPCA +
Q2.ReusingProductsPCA + Q2.RecyclingAndCompostingPCA +  Q2.LandfillPCA.
EXECUTE.
```

***Q3- Knowledge**

```
RECODE Q3.Recycling (3=1) (1 thru 2=0) INTO Q3.RecyclingR.
VARIABLE LABELS  Q3.RecyclingR 'Q3. Recycling Recoded'.
EXECUTE.

RECODE Q3.Composting (3=1) (1 thru 2=0) INTO Q3.CompostingR.
VARIABLE LABELS  Q3.CompostingR 'Q3. Composting Recoded'.
EXECUTE.

RECODE Q3.Incineration (3=1) (1 thru 2=0) INTO Q3.IncinerationR.
VARIABLE LABELS  Q3.IncinerationR 'Q3. Incineration Recoded'.
EXECUTE.

RECODE Q3.Landfill (3=1) (1 thru 2=0) INTO Q3.LandfillR.
VARIABLE LABELS  Q3.LandfillR 'Q3.Landfill Recoded'.
EXECUTE.

RECODE Q3.WasteSeparation (3=1) (1 thru 2=0) INTO Q3.WasteSeparationR.
VARIABLE LABELS  Q3.WasteSeparationR 'Q3.WasteSeparation Recoded'.
EXECUTE.

RECODE Q3.Decomposition (3=1) (1 thru 2=0) INTO Q3.DecompositionR.
VARIABLE LABELS  Q3.DecompositionR 'Q3.Decomposition Recoded'.
EXECUTE.

RECODE Q3.Sustainability (3=1) (1 thru 2=0) INTO Q3.SustainabilityR.
VARIABLE LABELS  Q3.SustainabilityR 'Q3.Decomposition Recoded'.
EXECUTE.


COMPUTE Q3TotalScore=Q3.Recycling +  Q3.Composting + Q3.Incineration + Q3.Landfill +
    Q3.WasteSeparation + Q3.Decomposition + Q3.Sustainability.
EXECUTE.

COMPUTE Q3TotalScoreR=Q3.RecyclingR +  Q3.CompostingR + Q3.IncinerationR + Q3.LandfillR +
    Q3.WasteSeparationR + Q3.DecompositionR + Q3.SustainabilityR.
EXECUTE.
```

***Q4 Total score - 7 points possible**

```
RECODE Q4.Glass Q4.Plastic Q4.Tinsandcans Q4.Clothes Q4.Paper Q4.Gardenwaste Q4.Mobilephones
    (SYSMIS=0) (1 thru 7=1).
EXECUTE.

RECODE Q4.Glass Q4.Plastic Q4.Tinsandcans Q4.Clothes Q4.Paper Q4.Gardenwaste Q4.Mobilephones
```

```
    (1=0) (2=1).
EXECUTE.

COMPUTE Q4TotalScore=Q4.Glass + Q4.Plastic + Q4.Tinsandcans + Q4.Clothes + Q4.Paper +
   Q4.Gardenwaste + Q4.Mobilephones.
EXECUTE.
```

***Q4 PCA Variables**

```
RECODE Q4.Glass (0=1) (1=2) INTO Q4.GlassPCA.
VARIABLE LABELS  Q4.GlassPCA 'Q4. Glass PCA'.
EXECUTE.

RECODE Q4.Plastic (0=1) (1=2) INTO Q4.PlasticPCA.
VARIABLE LABELS  Q4.PlasticPCA 'Q4. Plastic PCA'.
EXECUTE.

RECODE Q4.Tinsandcans (0=1) (1=2) INTO Q4.TinsandcansPCA.
VARIABLE LABELS  Q4.TinsandcansPCA 'Q4. Tins and cans PCA'.
EXECUTE.

RECODE Q4.Clothes (0=1) (1=2) INTO Q4.ClothesPCA.
VARIABLE LABELS  Q4.ClothesPCA 'Q4. Clothes PCA'.
EXECUTE.

RECODE Q4.Paper (0=1) (1=2) INTO Q4.PaperPCA.
VARIABLE LABELS  Q4.PaperPCA 'Q4. Paper PCA'.
EXECUTE.

RECODE Q4.Gardenwaste (0=1) (1=2) INTO Q4.GardenwastePCA.
VARIABLE LABELS  Q4.GardenwastePCA 'Q4. GardenwastePCA'.
EXECUTE.

RECODE Q4.Mobilephones (0=1) (1=2) INTO Q4.MobilephonesPCA.
VARIABLE LABELS  Q4.MobilephonesPCA 'Q4. Mobile phones PCA'.
EXECUTE.
```

***Q4 total score for CATPCA**

```
COMPUTE Q4TotalScorePCA=Q4.GlassPCA + Q4.PlasticPCA + Q4.TinsandcansPCA +
Q4.ClothesPCA + Q4.PaperPCA +
   Q4.GardenwastePCA + Q4.MobilephonesPCA.
EXECUTE.
```

***Q5 Total Score**

```
COMPUTE Q5TotalScore=Q5.Feelbotheredbylitter + Q5.Talktofriendsandfamilyaboutwaste +
Q5.Keepafoodwrapperwithyou  +
   Q5.Usebothsidesofpaper + Q5.Sortwaste + Q5.Reusethings.
EXECUTE.
```

***Q6 Total score**

```
COMPUTE Q6TotalScore= Q6.IgnoreSinceTheCleanerPicksItUp + Q6.Tellhimitisnotoktolitter + Q6.Suggestyourteacher + Q6.PickItUpYourself + Q6.AskThemToPutItInTheBin.
EXECUTE.
```

***Q6 Total score**

```
COMPUTE Q6TotalScorePCA= Q6.Tellhimitisnotoktolitter + Q6.Suggestyourteacher + Q6.PickItUpYourself + Q6.AskThemToPutItInTheBin.
EXECUTE.
```

***Total knowledge score**

```
COMPUTE TotalKnowledgeScore=(Q2TotalScore + Q3TotalScore + Q4TotalScore) / 19.
EXECUTE.
```

***Total attitude score**

```
COMPUTE TotalAttitudeScore=(Q1TotalScore + Q5TotalScore + Q6TotalScore) / 60.
EXECUTE.
```

***CATPCA - attitude**

```
CATPCA VARIABLES=Q1.ReducingWasteAtHome Q5.Feelbotheredbylitter
Q5.Keepafoodwrapperwithyou
   Q5.Talktofriendsandfamilyaboutwaste Q5.Usebothsidesofpaper Q5.Sortwaste Q5.Reusethings
   Q6.Tellhimitisnotoktolitter Q6.AskThemToPutItInTheBin Q6.PickItUpYourself
Q6.Suggestyourteacher
  /ANALYSIS=Q1.ReducingWasteAtHome(WEIGHT=1,LEVEL=ORDI)
   Q5.Feelbotheredbylitter(WEIGHT=1,LEVEL=ORDI)
Q5.Keepafoodwrapperwithyou(WEIGHT=1,LEVEL=ORDI)
   Q5.Talktofriendsandfamilyaboutwaste(WEIGHT=1,LEVEL=ORDI)
   Q5.Usebothsidesofpaper(WEIGHT=1,LEVEL=ORDI) Q5.Sortwaste(WEIGHT=1,LEVEL=ORDI)
   Q5.Reusethings(WEIGHT=1,LEVEL=ORDI)
Q6.Tellhimitisnotoktolitter(WEIGHT=1,LEVEL=ORDI)
   Q6.AskThemToPutItInTheBin(WEIGHT=1,LEVEL=ORDI)
Q6.PickItUpYourself(WEIGHT=1,LEVEL=ORDI)
   Q6.Suggestyourteacher(WEIGHT=1,LEVEL=ORDI)
  /DISCRETIZATION=Q1.ReducingWasteAtHome(RANKING) Q5.Feelbotheredbylitter(RANKING)
   Q5.Keepafoodwrapperwithyou(RANKING) Q5.Talktofriendsandfamilyaboutwaste(RANKING)
   Q5.Usebothsidesofpaper(RANKING) Q5.Sortwaste(RANKING) Q5.Reusethings(RANKING)
   Q6.Tellhimitisnotoktolitter(RANKING) Q6.AskThemToPutItInTheBin(RANKING)
   Q6.PickItUpYourself(RANKING) Q6.Suggestyourteacher(RANKING)
  /MISSING=Q1.ReducingWasteAtHome(PASSIVE,MODEIMPU)
Q5.Feelbotheredbylitter(PASSIVE,MODEIMPU)
   Q5.Keepafoodwrapperwithyou(PASSIVE,MODEIMPU)
Q5.Talktofriendsandfamilyaboutwaste(PASSIVE,MODEIMPU)
```

```
    Q5.Usebothsidesofpaper(PASSIVE,MODEIMPU) Q5.Sortwaste(PASSIVE,MODEIMPU)
    Q5.Reusethings(PASSIVE,MODEIMPU) Q6.Tellhimitisnotoktolitter(PASSIVE,MODEIMPU)
    Q6.AskThemToPutItInTheBin(PASSIVE,MODEIMPU)
Q6.PickItUpYourself(PASSIVE,MODEIMPU)
    Q6.Suggestyourteacher(PASSIVE,MODEIMPU)
  /DIMENSION=1
  /NORMALIZATION=VPRINCIPAL
  /MAXITER=100
  /CRITITER=.00001
  /ROTATION=NOROTATE
  /RESAMPLE=NONE
  /PRINT=CORR LOADING
  /PLOT=BIPLOT(LOADING) (20) OBJECT (20) LOADING(20) VAF
TRANS(Q1.ReducingWasteAtHome
    Q5.Feelbotheredbylitter Q5.Keepafoodwrapperwithyou Q5.Talktofriendsandfamilyaboutwaste
    Q5.Usebothsidesofpaper Q5.Sortwaste Q5.Reusethings Q6.Tellhimitisnotoktolitter
    Q6.AskThemToPutItInTheBin Q6.PickItUpYourself Q6.Suggestyourteacher) (20).
```

***CATPCA - knowledge**

```
CATPCA VARIABLES=Q4TotalScorePCA Q2TotalScorePCA
  /ANALYSIS=Q4TotalScorePCA(WEIGHT=1,LEVEL=SPORD,DEGREE=2,INKNOT=2)
    Q2TotalScorePCA(WEIGHT=1,LEVEL=SPORD,DEGREE=2,INKNOT=2)
  /DISCRETIZATION=Q4TotalScorePCA(RANKING) Q2TotalScorePCA(RANKING)
  /MISSING=Q4TotalScorePCA(PASSIVE,MODEIMPU) Q2TotalScorePCA(PASSIVE,MODEIMPU)
  /DIMENSION=1
  /NORMALIZATION=VPRINCIPAL
  /MAXITER=100
  /CRITITER=.00001
  /ROTATION=NOROTATE
  /RESAMPLE=NONE
  /PRINT=CORR LOADING
  /PLOT=BIPLOT(LOADING) (20) OBJECT (20) LOADING(20)  VAF TRANS(Q4TotalScorePCA
Q2TotalScorePCA)
    (20).
```

***Total attitude score after CATPCA**

```
COMPUTE TotalAttitudeScorePCA=(Q1TotalScore + Q5TotalScore + Q6TotalScorePCA) / 55.
EXECUTE.
```

***Total knowledge score using CATPCA results**

```
COMPUTE TotalKnowledgeScorePCA=(Q2TotalScore + Q4TotalScore) / 12.
EXECUTE.
```

***Mann-Whitney test for knowledge score after CATPCA**

```
DATASET ACTIVATE DataSet1.
NPAR TESTS
  /M-W= TotalKnowledgeScorePCA BY Treatment(1 2)
```

```
  /STATISTICS=DESCRIPTIVES QUARTILES
  /MISSING ANALYSIS.
```

***Mann-Whitney test for attitude score after CATPCA**

```
DATASET ACTIVATE DataSet1.
NPAR TESTS
  /M-W= TotalKnowledgeScorePCA BY Treatment(1 2)
  /STATISTICS=DESCRIPTIVES QUARTILES
  /MISSING ANALYSIS.
```

***Recoding age for MANOVA**

```
RECODE Age (9 thru 11=9) (12 thru 14=12)(15 thru 18=0) INTO AgeR.
VARIABLE LABELS  AgeR 'Age recoded for MANOVA'.
EXECUTE.
```

***outliers for MANOVA - 2 dependent variables**

```
SORT CASES BY MAH_1 (D).
USE ALL.
COMPUTE filter_$=(MAH_1  <= 13.82).
VARIABLE LABELS filter_$ 'MAH_1  <= 13.82 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
```

***Testing multicollinearity assumption for MANOVA**

```
CORRELATIONS
  /VARIABLES=TotalAttitudeScorePCA TotalKnowledgeScorePCA
  /PRINT=TWOTAIL NOSIG
  /MISSING=PAIRWISE.
```

Appendix D: attitude transformation plots

Nominal analysis level

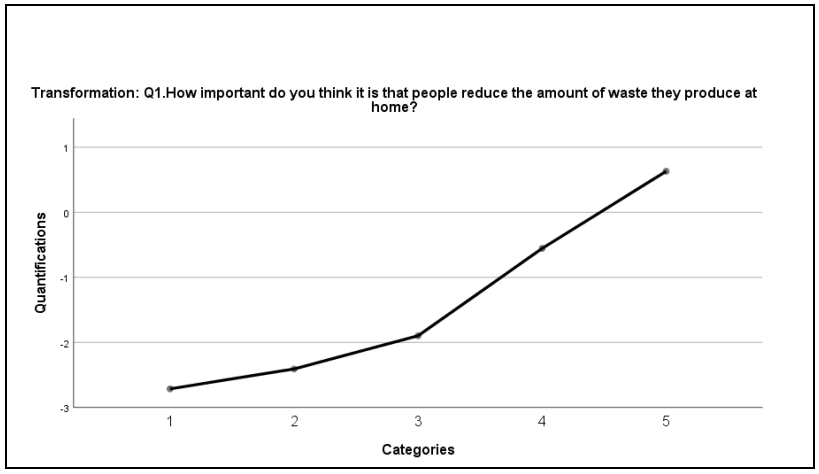


Figure D.1. *Transformation plot for Q1 items at the nominal level.*

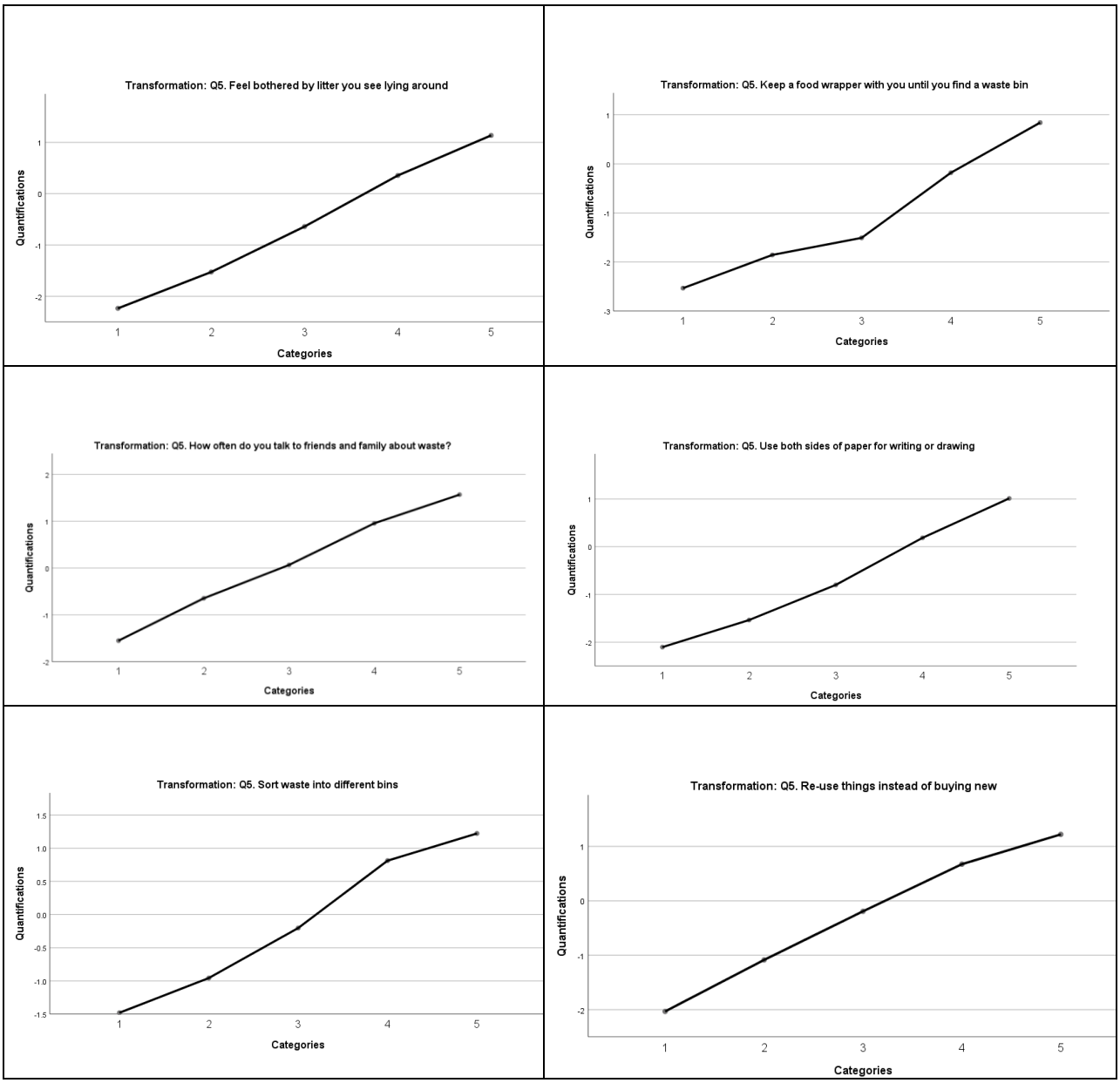


Figure D.2. *Transformation plot for Q5 items at the nominal level.*

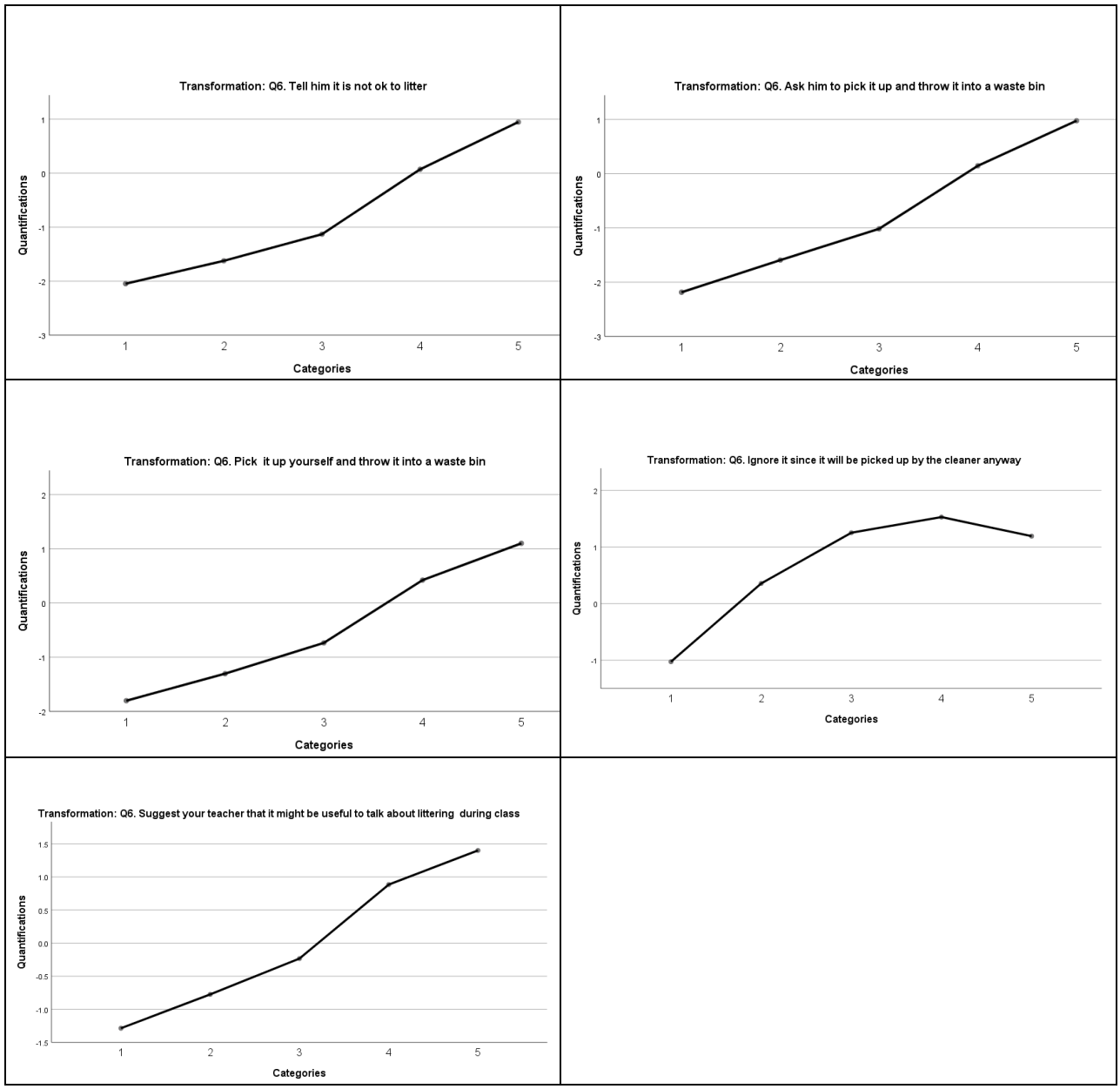


Figure D.3. *Transformation plot for Q6 items at the nominal level.*

Ordinal analysis level

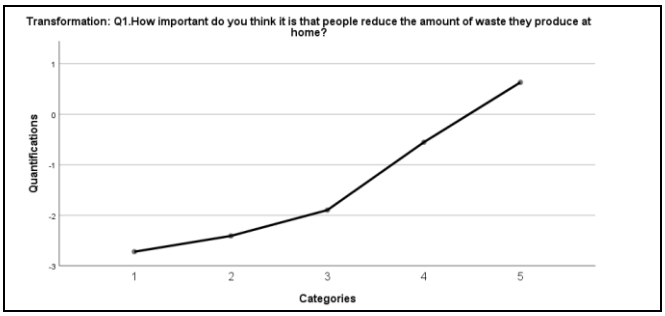


Figure D.4. *Transformation plot for Q1 items at the ordinal level.*

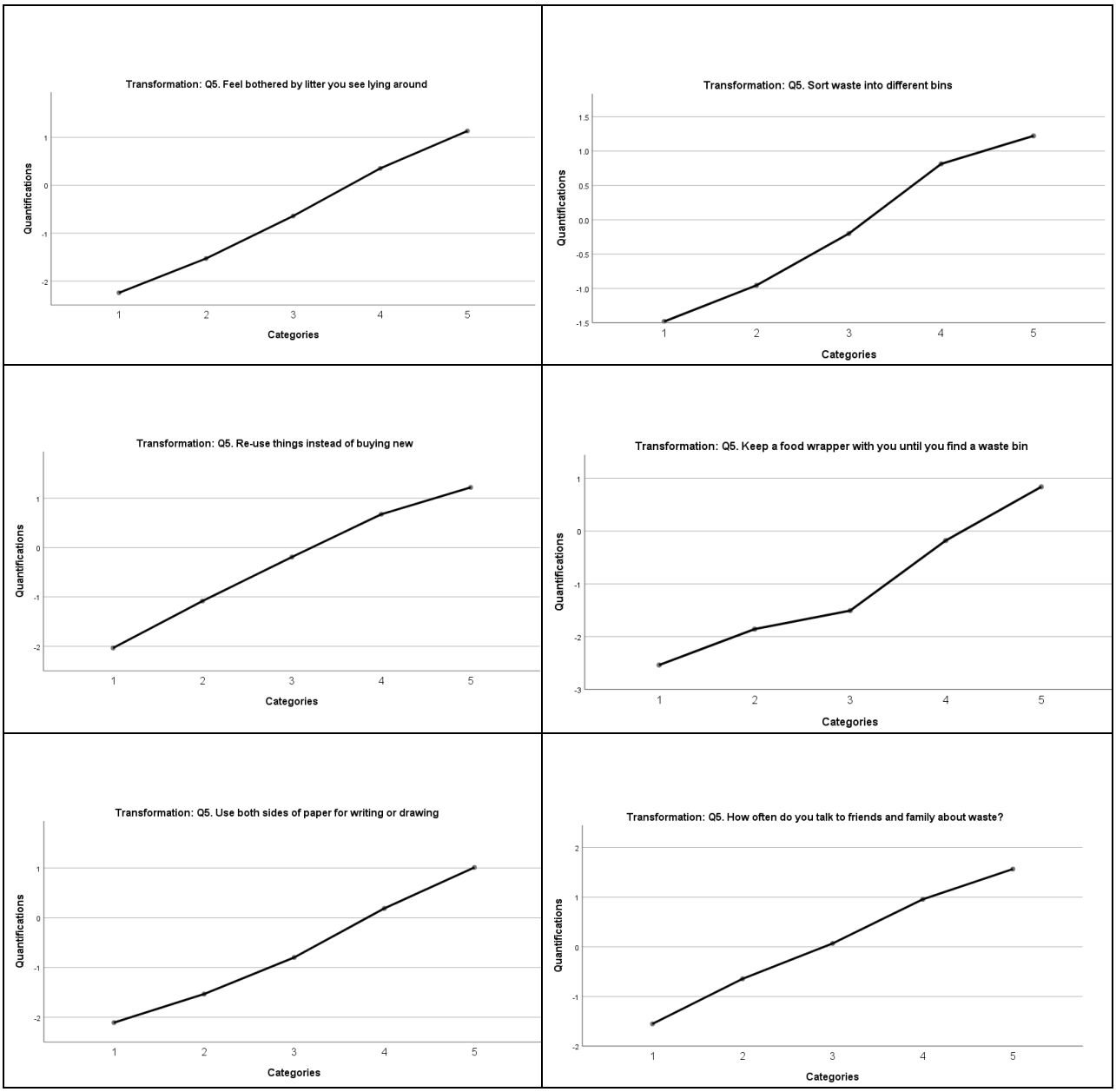


Figure D.5. *Transformation plot for Q5 items at the ordinal level.*

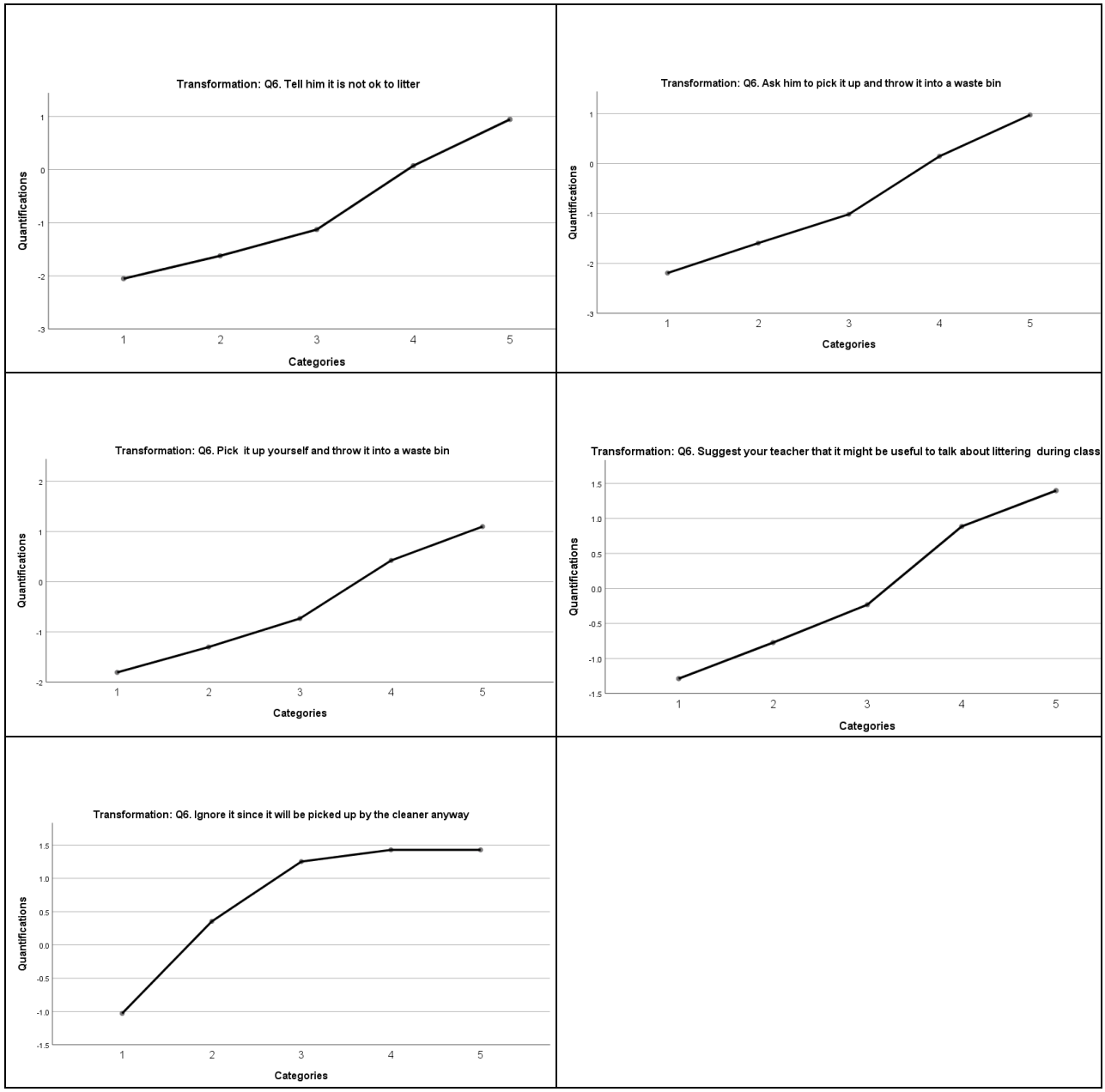


Figure D.6. *Transformation plot for Q6 items at the ordinal level.*

Appendix E: knowledge transformation plots

Nominal analysis level

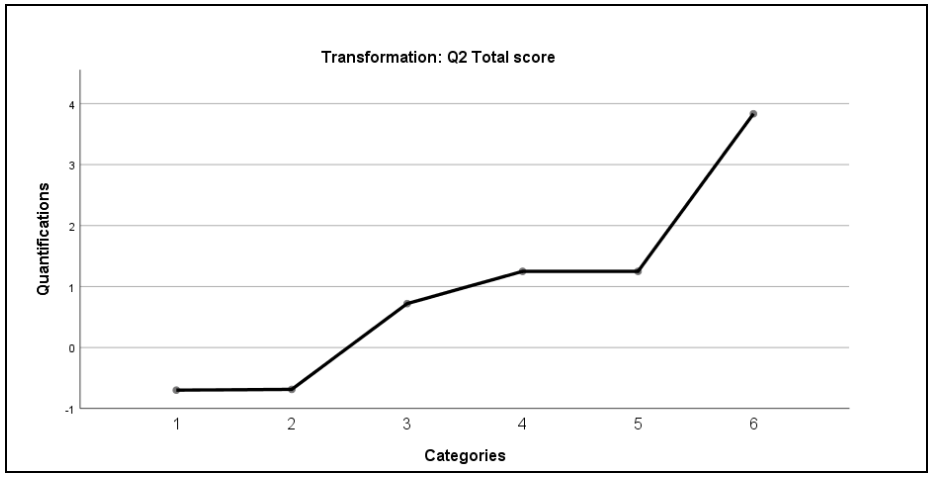
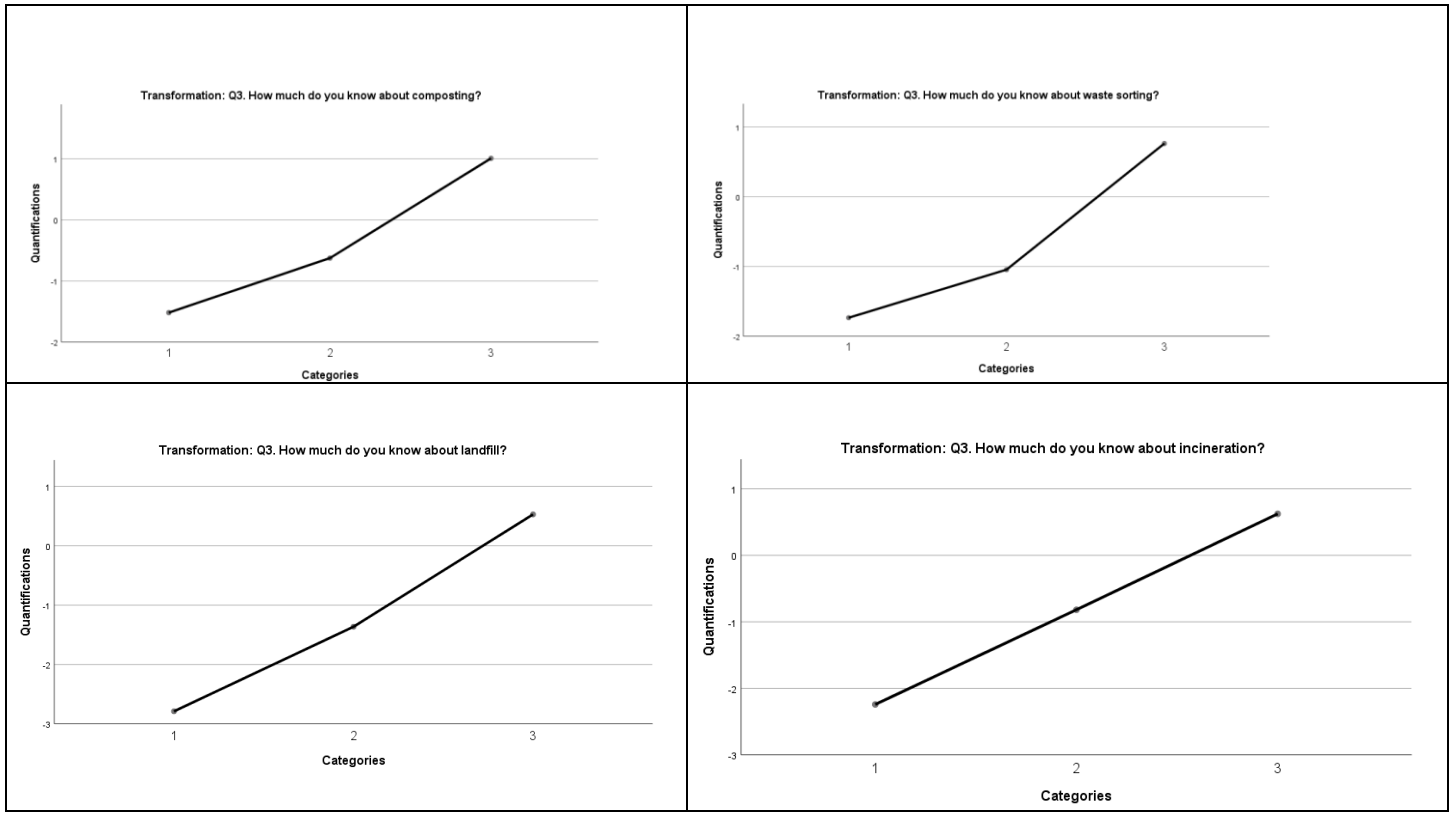


Figure E.1. *Transformation plot for Q2 scores at the nominal level.*



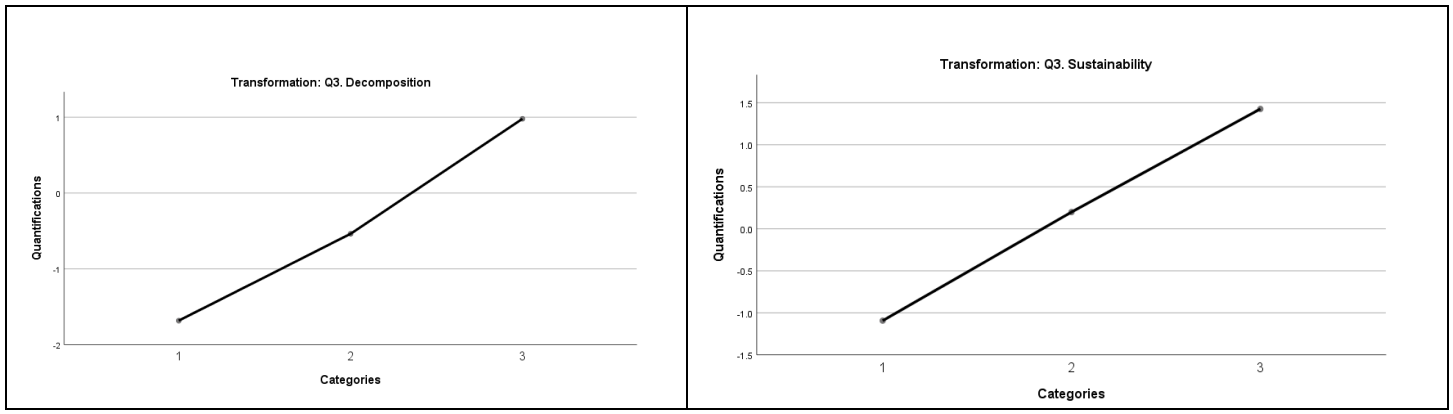


Figure E.2. *Transformation plot for Q3 items at the nominal level.*

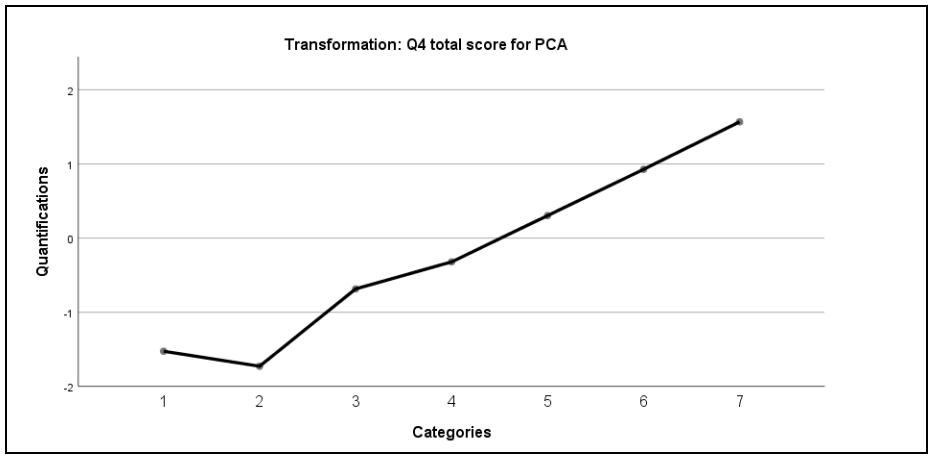


Figure E.3. *Transformation plot for Q4 scores at the nominal level.*

Ordinal analysis level

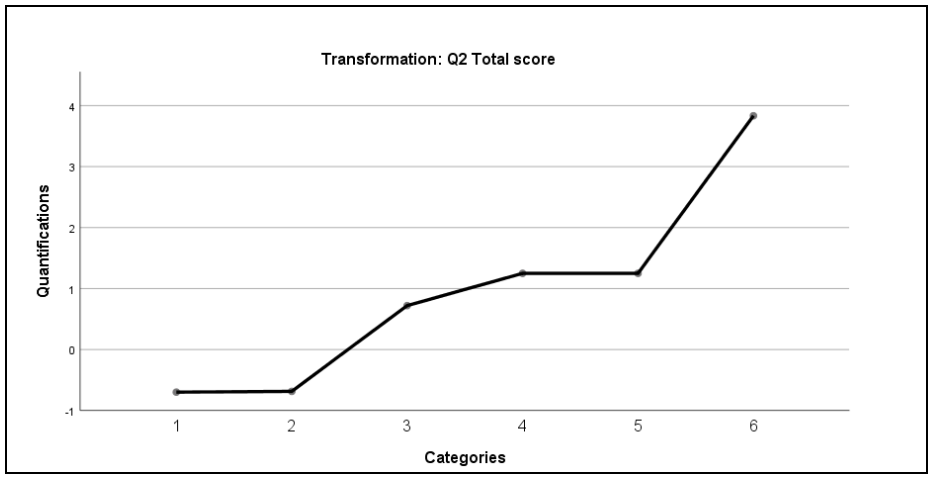


Figure E.4. *Transformation plot for Q2 scores at the ordinal level.*

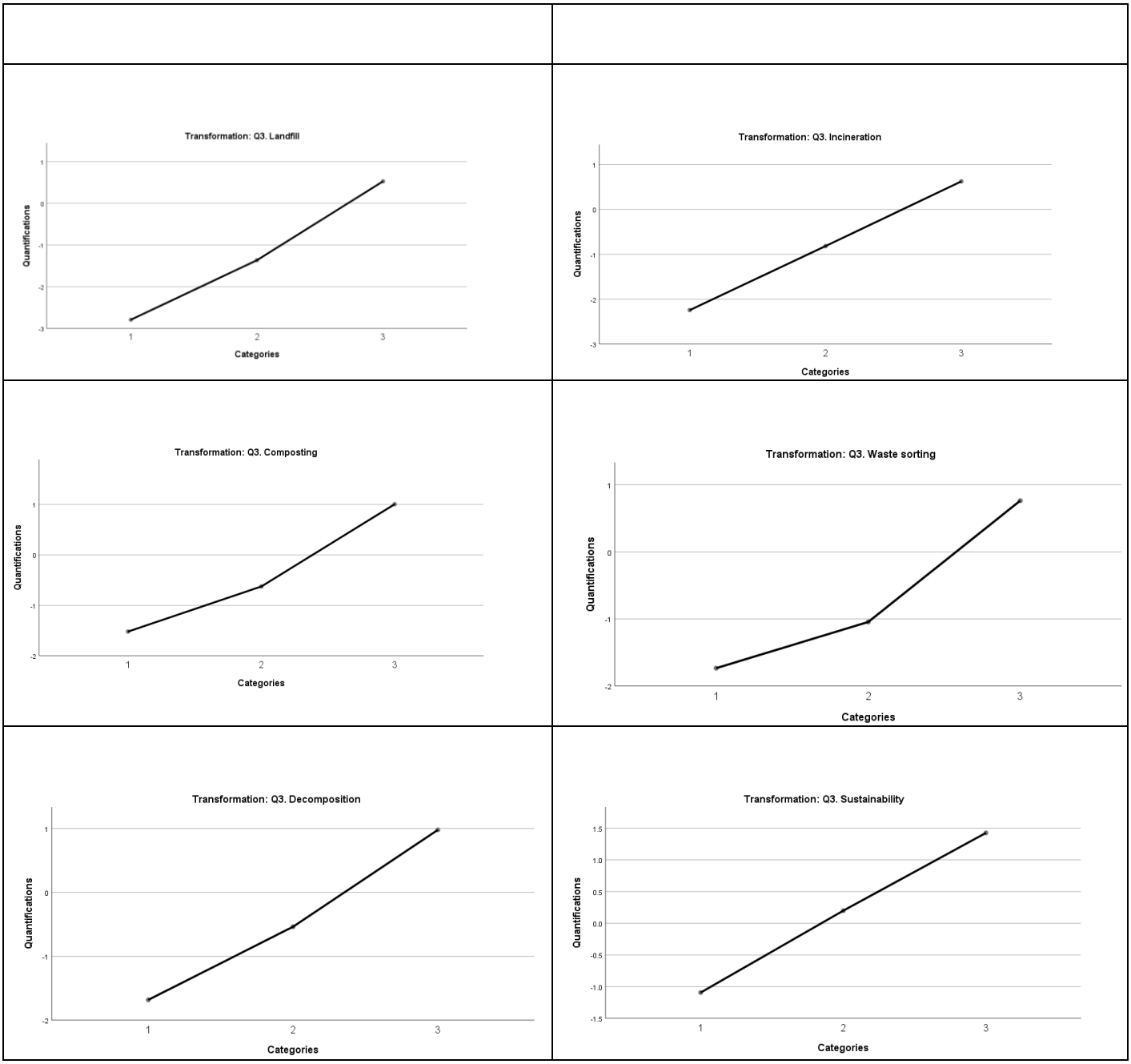


Figure E.5. *Transformation plots for Q3 items at the ordinal level.*

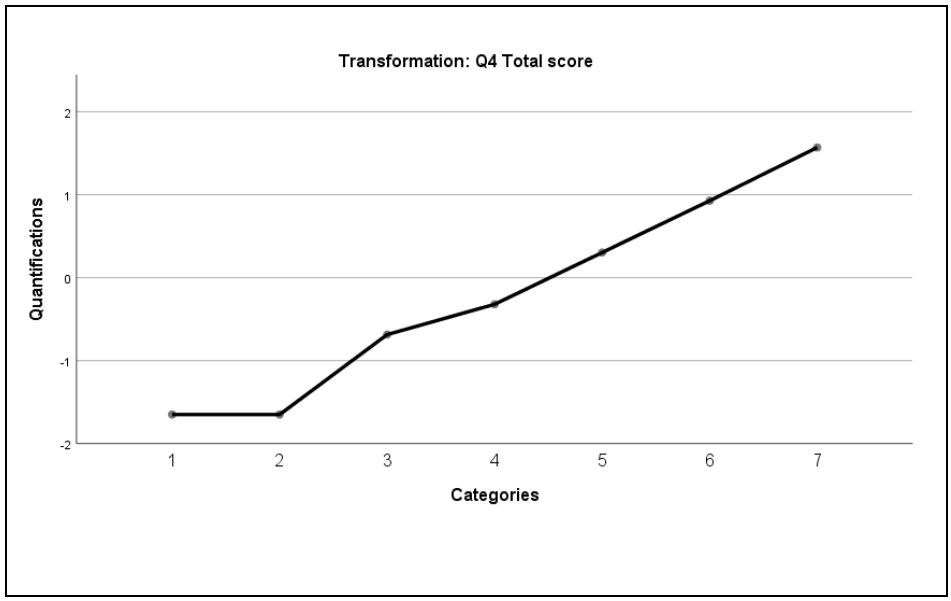


Figure E.6. *Transformation plot for Q4 scores at the ordinal level.*

Appendix F: 2 dimensional CATPCA on all variables

Several CATPCA analyses were run to determine the best model. First, a two-dimensional solution at a nominal analysis level for the 12 variables yielded a total VAF of 54.85%. The VAF was the same at the ordinal level. The transformation plots for almost all variables showed consistently increasing quantifications for each category, but the transformation plot for *Q6. Ignore it* showed a plateau between the 4 and 5 categories at both the nominal and ordinal level. For this reason, the ordinal analysis level was selected for the analysis. Case 606 was found to be an outlier and was removed from the analysis. All the variables except *Q6. Ignore it* had a VAF less than 0.3. *Q6. Ignore it* had a VAF of 0.33. In the first round of analysis on all variables at spline nominal, CATPCA detects four components but the percent of explained variance is less than 7% for components four through eight. The mean variance for all components, save one, is less than 0.10, suggesting that they do not contribute to the variance significantly. It is recommended to remove items with a mean variance less than 0.10 so eight components are not feasible because the mean variance is too low for each variable. When two dimensions are defined with varimax rotation 32.2% of the variance is explained. 11 items have a mean variance close to or less than 0.10 and all of these items belong to the knowledge questions 2 and 4. From this analysis it was concluded that all of the variables could not be analysed together.

Dimension	Cronbach's Alpha	Variance Accounted For	
		Total (Eigenvalue)	% of Variance
1	0.894	5.536	46.133
2	0.048	1.046	8.717
Total	0.925a	6.582	54.850

Table E.1. *VAF and Cronbach's Alpha across all variables together*.

	Centroid Coordinates									Total (Vector Coordinates)								
	Dimension								Mean	Dimension								Total
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8	
Q6. Tell him it is not ok to litter	0.641	0.005	0.038	0.010	0.007	0.002	0.008	0.010	0.090	0.641	0.002	0.022	0.005	0.005	0.000	0.003	0.000	0.678
Q6. Ask him to pick it up and throw	0.612	0.002	0.022	0.005	0.023	0.004	0.011	0.004	0.085	0.612	0.001	0.014	0.002	0.019	0.001	0.005	0.000	0.655
Q5. Feel bothered by litter you see	0.522	0.036	0.021	0.030	0.015	0.004	0.008	0.015	0.082	0.521	0.024	0.016	0.027	0.006	0.000	0.007	0.000	0.600
Q6. Pick it up yourself and throw i	0.458	0.058	0.007	0.006	0.007	0.010	0.006	0.004	0.070	0.458	0.057	0.001	0.004	0.004	0.004	0.003	0.000	0.530
Q5. Keep a food wrapper with you	0.458	0.003	0.017	0.008	0.022	0.008	0.006	0.109	0.079	0.455	0.002	0.009	0.007	0.017	0.005	0.004	0.103	0.601
Q5. How often do you talk to frien	0.375	0.163	0.025	0.025	0.008	0.009	0.004	0.026	0.079	0.371	0.160	0.022	0.016	0.005	0.008	0.003	0.018	0.603
Q6. Suggest your teacher that it mi	0.368	0.144	0.010	0.009	0.010	0.012	0.004	0.045	0.075	0.366	0.141	0.004	0.003	0.006	0.008	0.000	0.042	0.570
Q5. Use both sides of paper for wr	0.319	0.034	0.006	0.024	0.028	0.001	0.012	0.021	0.056	0.319	0.033	0.002	0.023	0.027	0.001	0.010	0.013	0.428
Q5. Re-use things instead of buyin	0.290	0.114	0.007	0.007	0.023	0.012	0.031	0.036	0.065	0.289	0.112	0.005	0.006	0.017	0.011	0.028	0.022	0.490
Q1.How important do you think it	0.279	0.025	0.069	0.011	0.012	0.003	0.012	0.032	0.055	0.279	0.023	0.062	0.005	0.007	0.001	0.008	0.029	0.413
Q6. Ignore it since it will be picked	0.269	0.039	0.007	0.026	0.101	0.006	0.004	0.026	0.060	0.266	0.034	0.000	0.022	0.101	0.000	0.000	0.016	0.439
Q5. Sort waste into different bins	0.263	0.258	0.047	0.020	0.014	0.019	0.013	0.017	0.081	0.263	0.257	0.039	0.011	0.012	0.016	0.010	0.004	0.613
Q3. How much do you know about	0.078	0.433	0.030	0.054	0.012	0.001	0.000	0.003	0.076	0.077	0.433	0.026	0.050	0.010	0.000	0.000	0.000	0.597
Q3. How much do you know about	0.083	0.335	0.000	0.058	0.036	0.002	0.016	0.043	0.072	0.082	0.335	0.000	0.052	0.035	0.002	0.016	0.041	0.562
Q3. How much do you know about	0.029	0.001	0.707	0.000	0.013	0.000	0.006	0.025	0.098	0.015	0.000	0.707	0.000	0.001	0.000	0.000	0.014	0.737
Q3. How much do you know about	0.017	0.002	0.669	0.001	0.002	0.001	0.013	0.003	0.089	0.017	0.000	0.669	0.000	0.001	0.000	0.013	0.000	0.701
Q3. How much do you know about	0.052	0.209	0.249	0.016	0.044	0.006	0.003	0.019	0.075	0.052	0.208	0.247	0.014	0.043	0.004	0.003	0.017	0.587
Q3. How much do you know about	0.093	0.151	0.169	0.035	0.007	0.001	0.004	0.069	0.066	0.093	0.151	0.169	0.034	0.007	0.001	0.004	0.069	0.528
Q4. Are clothes recyclable?	0.011	0.017	0.000	0.490	0.002	0.000	0.004	0.009	0.067	0.011	0.017	0.000	0.490	0.002	0.000	0.004	0.009	0.533
Q4. Is garden waste recyclable?	0.027	0.046	0.000	0.411	0.000	0.000	0.004	0.000	0.061	0.027	0.046	0.000	0.411	0.000	0.000	0.004	0.000	0.487
Q4. Are mobile phones recyclable?	0.012	0.009	0.005	0.381	0.077	0.009	0.000	0.027	0.065	0.012	0.009	0.005	0.381	0.077	0.009	0.000	0.027	0.520
Q4. Is paper recyclable?	0.045	0.067	0.030	0.185	0.001	0.001	0.002	0.117	0.056	0.045	0.067	0.030	0.185	0.001	0.001	0.002	0.117	0.447
Q4. Is plastic recyclable?	0.020	0.001	0.006	0.001	0.537	0.002	0.003	0.001	0.071	0.020	0.001	0.006	0.001	0.537	0.002	0.003	0.001	0.571
Q4. Are tins and cans recyclable?	0.003	0.044	0.018	0.102	0.296	0.002	0.022	0.000	0.061	0.003	0.044	0.018	0.102	0.296	0.002	0.022	0.000	0.487
Q4. Is glass recyclable?	0.012	0.017	0.011	0.053	0.209	0.017	0.044	0.066	0.054	0.012	0.017	0.011	0.053	0.209	0.017	0.044	0.066	0.429
Q2. Stop buying things	0.015	0.006	0.002	0.005	0.002	0.737	0.029	0.019	0.102	0.003	0.002	0.000	0.003	0.000	0.736	0.000	0.008	0.754
Q2.Burning For Energy	0.013	0.002	0.002	0.011	0.005	0.535	0.041	0.124	0.092	0.008	0.001	0.001	0.002	0.004	0.529	0.004	0.116	0.665
Q2. Recycling and composting	0.025	0.007	0.001	0.004	0.026	0.021	0.671	0.003	0.095	0.023	0.004	0.000	0.002	0.021	0.020	0.671	0.001	0.742
Q2. Disposing waste in a landfill	0.017	0.034	0.014	0.023	0.004	0.059	0.541	0.027	0.090	0.013	0.032	0.010	0.017	0.001	0.051	0.540	0.026	0.689
Q2. Re-using waste/Re-using prod	0.011	0.033	0.021	0.002	0.013	0.060	0.054	0.454	0.081	0.003	0.032	0.011	0.000	0.008	0.058	0.029	0.452	0.594
Q3. How much do you know about	0.120	0.086	0.052	0.002	0.166	0.011	0.009	0.187	0.079	0.118	0.069	0.042	0.002	0.164	0.009	0.009	0.186	0.599
Active Total	5.535	2.379	2.263	2.014	1.721	1.557	1.584	1.541	2.324	5.472	2.312	2.150	1.928	1.643	1.499	1.448	1.400	17.851
% of Variance	17.856	7.674	7.299	6.496	5.553	5.022	5.110	4.970	7.497	17.652	7.459	6.934	6.219	5.301	4.835	4.670	4.516	57.585
a Rotation Method: Varimax with Kaiser Normalization.																		

Table E.2. *Selecting variables based on variance (highlighted items have low variance and should be removed).*

In the second round of analysis, the total score of each question was analysed. One dimension resulted, based on eigenvalues. Cronbach's alpha is low and only acceptable for one dimension. This was not an accurate representation of the data so it was not used.

Dimension	Cronbach's Alpha	Variance Accounted For	
		Total (Eigenvalue)	% of Variance
1	0.758	2.715	45.256
2	-0.059	0.953	15.890
3	-0.274	0.814	13.567
4	-0.567	0.679	11.321
5	-1.023	0.540	8.996
6	-2.823	0.298	4.971
Total	1.000a	6.000	100.000
a Total Cronbach's Alpha is based on the total Eigenvalue.			

Table E.3. *VAF and Cronbach's Alpha across total question score variables.*

	Variance Accounted For															
	Centroid Coordinates							Total (Vector Coordinates)								
	Dimension						Mean	Dimension								Total
	1	2	3	4	5	6		1	2	3	4	5	6			
Q5 total score	0.746	0.020	0.031	0.086	0.036	0.197	0.186	0.742	0.003	0.000	0.055	0.018	0.182			1.000
Q6 total score	0.617	0.059	0.020	0.218	0.056	0.130	0.183	0.603	0.042	0.006	0.209	0.036	0.105			1.000
Q3 total score	0.587	0.013	0.029	0.014	0.439	0.004	0.181	0.563	0.008	0.019	0.004	0.404	0.002			1.000
Q1 total score	0.431	0.035	0.361	0.294	0.015	0.009	0.191	0.347	0.034	0.341	0.264	0.013	0.002			1.000
Q2 total score	0.099	0.841	0.057	0.010	0.004	0.003	0.169	0.097	0.841	0.053	0.005	0.001	0.002			1.000
Q4 total score	0.373	0.032	0.399	0.150	0.076	0.019	0.175	0.364	0.025	0.395	0.142	0.068	0.006			1.000
Active Total	2.852	1.002	0.897	0.773	0.626	0.362	1.085	2.715	0.953	0.814	0.679	0.540	0.298			6.000
% of Variance	47.530	16.695	14.946	12.878	10.427	6.027	18.084	45.256	15.890	13.567	11.321	8.996	4.971			100.000

Table E.4. *Selecting variables based on variance (highlighted items have low variance and should be removed).*

In the third round of analysis, the total scores for question 2 and question 4 were used instead of each sub question because of their nominal and binary nature. The other items (Q1, Q3, Q5, and Q6) were used as they are because of their ordinal nature. Based on the eigenvalues, this resulted in the components decreasing from eight to four. Based on the mean VAF, Q2 total score should be removed from the analysis. This was an indicator that the knowledge items needed to be analysed separately from the attitude items.

Dimension	Cronbach's Alpha	Variance Accounted For	
		Total (Eigenvalue)	% of Variance
1	0.908	7.387	35.175
2	0.457	1.772	8.438
3	0.274	1.353	6.443
4	0.124	1.134	5.401
Total	0.960a	11.646	55.456
a Total Cronbach's Alpha is based on the total Eigenvalue.			

Table E.5. *VAF and Cronbach's Alpha for third round of analysis.*

Variance Accounted For										
	Centroid Coordinates					Total (Vector Coordinates)				
	Dimension				Mean	Dimension				Total
	1	2	3	4		1	2	3	4	
Q6. Tell him it is not ok to litter	0.550	0.017	0.143	0.007	0.179	0.549	0.000	0.141	0.000	0.690
Q6. Ask him to pick it up and throw it into a w	0.521	0.010	0.142	0.004	0.169	0.520	0.002	0.140	0.003	0.665
Q5. Feel bothered by litter you see lying arou	0.506	0.006	0.075	0.045	0.158	0.505	0.001	0.066	0.008	0.580
Q5. How often do you talk to friends and fam	0.484	0.003	0.013	0.152	0.163	0.483	0.001	0.002	0.148	0.633
Q6. Pick it up yourself and throw it into a wa	0.456	0.021	0.036	0.033	0.136	0.455	0.015	0.035	0.028	0.533
Q5. Keep a food wrapper with you until you f	0.416	0.013	0.074	0.104	0.152	0.416	0.004	0.073	0.103	0.596
Q5. Re-use things instead of buying new	0.413	0.064	0.003	0.021	0.125	0.412	0.062	0.002	0.002	0.479
Q5. Sort waste into different bins	0.414	0.148	0.030	0.045	0.159	0.411	0.142	0.029	0.033	0.614
Q5. Use both sides of paper for writing or dra	0.411	0.015	0.003	0.018	0.112	0.411	0.012	0.002	0.009	0.433
Q6. Suggest your teacher that it might be use	0.392	0.013	0.023	0.236	0.166	0.389	0.008	0.012	0.233	0.643
Q1.How important do you think it is that peo	0.377	0.021	0.013	0.020	0.108	0.377	0.013	0.012	0.009	0.411
Q3. How much do you know about sustainab	0.362	0.005	0.190	0.055	0.153	0.362	0.000	0.189	0.055	0.606
Q3. How much do you know about composti	0.355	0.023	0.211	0.003	0.148	0.355	0.023	0.210	0.002	0.589
Q3. How much do you know about waste sor	0.352	0.071	0.068	0.001	0.123	0.351	0.069	0.068	0.001	0.489
Q3. How much do you know about recycling?	0.350	0.015	0.068	0.173	0.151	0.350	0.004	0.052	0.171	0.578
Q3. How much do you know about decompo	0.320	0.152	0.096	0.001	0.142	0.320	0.150	0.095	0.001	0.566
Q4 total score for PCA	0.295	0.015	0.130	0.099	0.135	0.289	0.012	0.125	0.061	0.487
Q2TotalScorePCA	0.056	0.015	0.037	0.016	0.031	0.056	0.008	0.034	0.014	0.112
Q3. How much do you know about incinerati	0.097	0.651	0.011	0.026	0.196	0.078	0.650	0.011	0.014	0.754
Q3. How much do you know about landfill?	0.108	0.575	0.002	0.007	0.173	0.108	0.575	0.002	0.002	0.687
Q6. Ignore it since it will be picked up by the c	0.209	0.026	0.052	0.252	0.135	0.189	0.021	0.052	0.238	0.499
Active Total	7.444	1.878	1.421	1.318	3.015	7.387	1.772	1.353	1.134	11.646
% of Variance	35.446	8.941	6.766	6.274	14.357	35.175	8.438	6.443	5.401	55.456

Table E.6. *Selecting variables based on variance (highlighted items have low variance and should be removed).*

Appendix G: Guidelines for monitoring the impact of the LLC in Eco-Schools

The text below describes the collection of data from Eco-Schools participating in the Litter Less Campaign.

The main purpose of the impact assessment is to demonstrate impact on student knowledge and behaviour/attitude to our sponsor Mars Wrigley following the implementation of the LLC. The secondary purpose is to evaluate the implementation of the campaign.

For this purpose we conduct a post-intervention anonymous online survey for students and teachers at the end of the campaign (Around April and October 2020 in the northern- and southern-hemisphere countries, respectively).

Assessment of the impact is done in relation to a reference (control) student group.

Instructions for NOs:

1. Please choose ES LLC schools that best represent the majority of the schools participating in the LLC. 50% of the schools in this group should be new schools (schools that haven't worked on the theme of Litter in the past two years at least).
2. Please choose Control schools that have similar characteristics to the LLC schools (in terms of size, student composition, geography) but that haven't participated in the LLC (or similar campaigns run by other NGOs) during the last 5 years as this can lead to underestimation of the impact.
3. Please choose the main teacher responsible for implementing the LLC to answer the teacher survey (Only one teacher).
4. Please try to get the number of responses specified in the table below. If the difference between the LLC and control student groups is too large it may lead to false conclusions. I will send updates with the number of surveys completed.
5. Please make sure that the learning outcomes following participation in the LLC is clear to the teachers during the teacher training workshop. We will send you information about the learning outcomes that are relevant to your theme.
6. Please let me know when you intend to start with data collection and consider holidays and exams in your plan. Based on your plan I will decide on a deadline for completing the data collection.
7. The surveys take about 5 minutes to complete and can be taken using mobiles, tablets or multiple PCs in a computer lab (The latter is the easiest).
8. Please inform the teachers that they need to choose 20 students of ages 9-13 (preferably 50% male and 50% female) to answer the student questionnaire.

Table 1: The number of schools and students to sample.

Target group	**Country**	**Number of ES-LLC schools**	**No. Of ES-LLC schools to be sampled**	**No of students per school (equal gender, ages 9-13)**	**Total number of students**
ES-LLC	Australia	30	8	20	150
	Ireland	25	6	20	125
	Russia	120	20	20	400
	Spain	30	8	20	150
	China	50	13	20	250
	Kenya	30	8	20	150
	Brazil	20	5	20	100
Total for ES-LLC	**7**	**305**	**66**	**140**	**1325**
Total for ES control	**7**	**305**	**66**	**140**	**1325**

Once I have a draft for the survey, I will circulate it so you can comment on it.

Let me know if you have any questions.

All the best

Appendix H: Interview transcript – Ireland

Speaker 1: Maddy
Speaker 2: National Operator in Ireland

00:00:02 Speaker 1
So how long have you been working with FEE?

00:00:38 Speaker 2
Gosh, good question.

00:00:40

00:00:41 Speaker 2
And so I've been working with an Toshka, the Irish national operator for four and a half years, and I've been working on the litter less campaign. Gosh I would say 3 1/2 four years. Yeah yeah I'm not 100% sure.

00:01:02 Speaker 1
OK, yeah.

00:01:02 Speaker 2
Yeah, I'd say about 3 1/2 years.

00:01:04 Speaker 1
Alright, awesome, so yeah, my analysis is of the past three years, so Ireland's and all three of those.

00:01:16 Speaker 1
Do you implement programs other than feed programs?

00:01:20 Speaker 2
No well do you mean me personally? Or do you mean the organization or what?

00:01:29 Speaker 1
Uh, yeah, more the organization. Do you do others?

00:01:33 Speaker 2
Yes, so uhm we would run our own national programs. So like there's the NEAT streets program, which would be quite similar to the litter less campaign, but it's for secondary schools, just working in Ireland and and yeah, we would run some other programs, but most of them are are fee. So green schools would be kind of the biggest one and then there'd be.

00:02:02 Speaker 2
Like the Blue Flag as well.

00:02:04 Speaker 1
Right of course OK and and for the litter less campaign, each country chooses like litter challenges to focus on. And do you know what Ireland chose each year?

00:02:22 Speaker 2
You mean like a specific topic to focus on?

00:02:25 Speaker 1
Yeah, like for the for the lesson plans.

00:02:29 Speaker 2
Yeah, I mean so last year. Uhm, well this year just gone. I had told them to focus on kind of composting and and yeah, kind of brown bin waste the year before we had been looking at single use plastics.
00:02:38

00:02:46 Speaker 2
Uhm, but to be honest I kind of just usually let them choose whichever lesson plans from the set lesson plans fit best for them. Once they've had a chance to have a look at them and and properly go through them, you know 'cause they don't want to be too prescriptive in what I'm I'm making them do 'cause every school is different, you know. And it also depends on what class age group the teacher in the school has. That's that's organizing it so. Uhm yeah. So I tend to kind of whittle it down to the ones that I think are most age appropriate and and then let them kind of pick from there.

00:03:28 Speaker 1
OK, yeah, so there's some freedom there. Uh, yeah, that is kind of answers my next question is, how does this school choice affect your recommendations for what they focus on. Yeah, are there any like Irish policies or like initiatives that kind of drive or influence the LLC curriculum? 'cause the LLC curriculum is based on the UN SDG's, but are there any more local policies that kind of influence?

00:04:09 Speaker 2
I mean, they're kind of doing it just for we're getting set up with green schools, so usually we take on schools for the LLC that are just starting out on green schools or eco schools and they would already be working towards their litter and waste flag. So we use the LLC to kind of reinforce that and and obviously they get the funding with it and that supports them to work on it in terms of kind of local policies that they're working towards. Not not really so much, UM. I mean. Uhm yeah, we would have a big emphasis on the SDG's as well and then a lot of schools would work with them. They're called tidy towns groups which are community groups which focus on keeping a particular town or village.

00:05:05 Speaker 2
Uhm, clean basically and litter free. So a lot of them would tie in with those and they might do.
00:05:07 Speaker 1
Right.

00:05:12 Speaker 2
On an auction day alongside those guys or they might get extra help and support from them, but that's not really related to us at all. It's kind of something that they would seek out themselves, or they might already have a relationship with those groups.

00:05:28 Speaker 1
OK.

00:05:28 Speaker 2
And yeah, I mean I suppose it's it is helping them get in line with, you know. So all of their their food waste, for example, is meant to be going into the the brown bin or the compost bin, but that's not really enforced. That's strictly in Ireland, and so in that way it is helping them to do that.

00:05:47 Speaker 1
OK.

00:05:50 Speaker 1
Alright, uh, and yeah, what do you think makes schools want to join the LLC? Because yeah, not all EcoSchools participate. Is there an incentive there? Is it mainly the funding you think or?

00:06:06 Speaker 2
Yeah, I think mainly the funding is a big incentive for.

00:06:10 Speaker 2
Uhm, so when they sign up I would usually give them, you know, like maybe 50% of the funding upfront and 50% at the end of the year. And I definitely find you need to hold off on giving them the full amount to, you know to make sure that they actually finish the year that they don't just sign up, whereas.

00:06:26 Speaker 1
Oh OK, right.

00:06:28 Speaker 2
Uhm, so yeah, I think that's a big incentive, especially for like we have a lot of small rural schools that want to take part. You know that aren't near a big city and they don't get much other support so.

00:06:28 Speaker 2
Uhm, so yeah, I think that's a big incentive, especially for like we have a lot of small rural schools that want to take part. You know that aren't near a big city and they don't get much other support. Huh, they're the ones that are usually interested for me, which can actually be a bit of a difficulty. Then when it comes to things like doing the knowledge impact survey because it's such a small number of students in the school, it's hard to find enough in the right age group, but they're the schools that want it, and they do a lot of work. You know they're very active.

00:07:03 Speaker 2
And then I mean, it just depends on the coordinator. I think sometimes you get teachers that are are really keen and eager to do it, and like they definitely find that they enjoy the extra support that they would get from me, say by taking part in the litter less campaign and the students really enjoy the.

00:07:18 Speaker 1
Right.

00:07:24 Speaker 2
The monitoring I think you know and kind of having that ownership of checking the bins every week and seeing have they gone down or have they gone off? Upper or what and so yeah, but I suppose initially at recruitment, yeah, it's kind of the the carrot of extra resources and expert funding.

00:07:42 Speaker 1
It makes sense. Yeah, it's uh, yeah it takes some effort, yeah, but would you say the success of an LLC program really depends on the coordinator that they have.

00:07:55 Speaker 2
Yeah, I would say so. And also like the support that they get from the principal or the other staff in the school. Uhm, you know sometimes you'll have a really keen coordinator, but maybe the principle isn't that

interested or just wants them to focus on the core curriculum. That's definitely been a an issue in the past year and a half, you know, because schools are just trying to catch up on maths, English and Irish and they don't have time to be focused.

00:08:17 Speaker 1
OK. Yeah, of course.

00:08:25 Speaker 2
Uhm, yeah. But yeah, I mean definitely. If you don't have an interested coordinator, then it's not going to work out, but most of the time like people are only in that role if they are interested in the 1st place, so usually they're very good. I know in some schools it's kind of like a post that's given and passed around to people, and they might not particularly know anything about it.

00:08:42 Speaker 1
Yeah, yeah.

00:08:50 Speaker 1

00:08:52 Speaker 2
So yeah, that's the only time I think when it can be a bit of an issue, but yeah, I think it's just kind of time. Demands are the biggest thing for for the teachers you know like.

00:09:05 Speaker 1
Yeah, always yeah. Poor guys yeah. Especially in COVID times so.

00:09:14 Speaker 1
Uh, so let's see what is my next question. Yeah, for those coordinators. Do they receive training from your organization or is it just the material they receive from FEE?

00:09:27 Speaker 2
Yes, they usually get some training from me at the start of the year. Uhm, so like last year I did a a zoom call with the teachers that were taking part and just kind of gave him a presentation guiding them through what was involved and we had a bit of a Q&A and. And yes, so I think they and that really helpful. And and then I checked in with them again a couple months later. We had a a second meeting, so I think particularly this year that was really good to have.

00:09:49 Speaker 1
Right. Yeah. Nice some ongoing support yeah uhm, OK and then.

00:10:07 Speaker 1
Uh, do you think there's a, uh, characteristic that is like other than the coordinator? Is there a characteristic that's shared by effective schools or successful schools with LLC?

00:10:24 Speaker 2
Well, like I say, I think I think yeah, the support of kind of the principal and the rest of the staff is definitely a big one.

00:10:32 Speaker 2

You know, some coordinators kind of feel like they're, they're just on their own kind of trying to do this thing, and they might be working with the staff who are really uncooperative or or not interested in kind of given up any free time.

00:10:44 Speaker 2
To it, or else they might feel. You know they might. There might just be a culture of you, know, you know they might be the first time recycling was brought into the school properly or something like that. Or, you know, people are getting more strict on what can actually go in the recycling.

00:11:00 Speaker 2
Then and some teachers will kind of feel like they don't want someone to be kind of scolding them or telling them what they're meant to be doing. So I think that's something that, yeah, I think definitely having support from other teachers is big help.

00:11:14 Speaker 2

00:11:15
Right?

00:11:16 Speaker 2
But I also think yeah, like letting the letting the students have ownership of the program and you know getting them as involved in. Kind of, you know, the decision-making process or.

00:11:28 Speaker 2
You know, you know they're creating the signs to put on the bins, or they're going around to the other classes and educating the other kids about what's meant to be done. Or some classes will have competitions where they'll have kind of like traffic light system.

00:11:44 Speaker 2
Uhm, to show how literate they've been and you know, then they'll gain like an extra 10 minutes of break time or something like that.
00:11:44 Speaker 1

00:11:53 Speaker 2
If if they win or something like that, you know, oh, I think getting the yeah, given the students kind of that little extra bit of.
00:11:55 Speaker 1

00:12:02 Speaker 2
Of ownership of it is really good.

00:12:05 Speaker 1
Yeah, the empowerment goes a long way, certainly.

00:12:09 Speaker 1
Uh, OK and and then yeah, kind of on the opposite side of that. Is there a characteristic that is seen in unsuccessful schools? I? I guess maybe it's just the opposite of students not being involved, or.
00:12:28 Speaker 2
Yeah, I'm yeah, I think it's just not enough support internally in the school, you know? Yeah, I think it just at the end of the day comes down to like time demands or the culture of the school and.

00:12:36 Speaker 1
OK.

00:12:44 Speaker 2
Yeah, it's like.

00:12:45 Speaker 2
How willing the individuals are to.

00:12:49
Kind of.

00:12:49 Speaker 2
Yeah, it's OK.

00:12:52 Speaker 1
That's clear, yeah.

00:12:53 Speaker 1
And and so she moaned, is a evaluation each year of all the different fee programs, but was wondering if you perform an assessment of your own to see how much students are gaining or this kind of an evaluation of schools.

00:13:11 Speaker 2
Uhm, for a little less.

00:13:14 Speaker 2

00:13:16 Speaker 2
Like not really, UM, so I would encourage them all to send me in there.

00:13:25 Speaker 2
Their measurement waits UM throughout the year, right? Like as they kind of get them done rather than waiting till the end of the year when they're filling out the final report, right?

00:13:37 Speaker 2
Because again, I just kind of feel like things can go by the wayside and they can kind of forget about it throughout the year.

00:13:43 Speaker 2
And then it comes to, you know, may and I'm asking them for six measurements, and they've completely forgotten about it.

00:13:50 Speaker 1
Right?

00:13:51 Speaker 2
Or, you know, so I think it's good to kind of do that and try and get them into the habit of it and.

00:13:57 Speaker 2
So that way I would be kind of just checking in with them all throughout the year, uhm?

00:14:03 Speaker 2
Yeah, and I kind of send them like a general update email every couple of months or I'm like. OK so this is going on or this is an opportunity or this is a new resource that you can use or something like that?

00:14:16 Speaker 2

00:14:18 Speaker 2
But yeah, I wouldn't. I wouldn't really be evaluating them. I mean, I'll have a look at the the results when they come in and see did they actually make improvement or not? And if there's something that looks really weird, I'll probably go back and question it with them.

00:14:26 Speaker 1
Right?

00:14:33 Speaker 2
And they would also send me in photographs throughout the year and tell me like kind of just offer me up stories about oh, we did this at Christmastime and this upcycling thing or whatever, and.

00:14:47 Speaker 2
And let me think what was that leading onto there?

00:14:51 Speaker 2
I think that's kind of it. Yeah, I mean I wouldn't. I wouldn't kind of.

00:14:55 Speaker 2
Assess them as such, but obviously I know as well from from being in contact with them. I would phone call them as well a couple of times a year and that really gives you a good feel about who is really interested and when working on it and who hasn't really looked at it since they signed up. You know, and then you can see some people that might drop off.

00:14:57 Speaker 1
Right?

00:15:16 Speaker 2
Over the course of the year.

00:15:17 Speaker 2
Uhm, but generally they're all very good, yeah?

00:15:17 Speaker 1
Right?

00:15:21 Speaker 1
OK.

00:15:22 Speaker 1
Yeah, related to the litter measurement. UM, do you think that system is? Are there any improvements to that like activity that can be done? Do you find it better to do it in, like in installments through the year?

00:15:43 Speaker 2

I think that the six measurements is probably a bit ambitious like I just think it's quite a lot to ask of teachers to do, because, well, for one thing, it's hard for them to get a block of time where that's uninterrupted. You know that's six weeks long.

00:16:03 Speaker 2
Because the school term is usually maybe six weeks or so, and then there will be 1/2 term or there will be a break or something which is always a bit of a disruptor, you know?

00:16:15 Speaker 2
So yeah, by the time they actually get signed up, get started. They've had training from me and then you know then it's kind of nearly Christmas time and they're focused on doing their school play or whatever. So yeah, I think maybe six is just a little bit too many and.

00:16:29 Speaker 2
Right?

00:16:35 Speaker 2
And, uh.

00:16:38 Speaker 2
What else can I?

00:16:38 Speaker 2
Say I'm.

00:16:42 Speaker 2
Yeah, I mean.

00:16:44 Speaker 2
You never really know for sure. I know. Obviously we're trying to analyze the data as rigorously as possible, but you know, I can give them all the guidelines in the world about, you know, use the same students and measure for the same amount of time and whatever. But you know you never really know if that's happening on the ground.

00:16:59 Speaker 1
Right?

00:17:02 Speaker 1

00:17:04 Speaker 1
There are so many factors.

00:17:04 Speaker 2
Like this year, yeah, at the start of the year, they'll sign up to do one particular criteria, and then as the year will go on, they'll be like Oh no. Actually we ended up doing this instead, you know, and.
00:17:18 Speaker 1
Right.

00:17:19 Speaker 2
So and then I'll have to go back and change the.

00:17:22 Speaker 2
The inputs or or whatever, so that's kind of something, UM.

00:17:23 Speaker 1
Oh, OK.

00:17:29 Speaker 2
Yeah, generally I think it's OK like I think they like to maybe yeah, I think the teachers prefer to say OK, we're doing this for the next six weeks in this block.

00:17:40 Speaker 2
Now we'll do it every Friday and go go go and then that's it and they're joined. So I find the teachers that do that are the ones that are more successful in.
00:17:43 Speaker 1

00:17:49 Speaker 2
In the program you know, and they just kind of get it done and get on with it and.
00:17:50 Speaker 1
OK.
00:17:54

00:17:55 Speaker 2
Whereas some of them are like dragging it out or you know, like I say, they get caught up with other activities and then they've only got one done here and one done 5 weeks later and you know so.
00:18:03 Speaker 1

00:18:06 Speaker 1
Got it.

00:18:08 Speaker 1
Yeah bradick yeah yeah, I'm trying to analyze that data and it yeah.

00:18:13 Speaker 1
It has its challenges so.

00:18:16 Speaker 1
Seeing how we can maybe improve that system.

00:18:19 Speaker 2
Yeah, sorry, some of them like a lot of them will sign up site to measure the litter in their schoolyard, but they might have very little litter in their schoolyard to start off with. So then they're like, oh?

00:18:19 Speaker 2
I'm actually collected .01 of a kilo of waste.

00:18:40 Speaker 2
That's not great, yes.

00:18:42 Speaker 1
Yeah, alright yeah, that's in enlightening. It's interesting. Yeah every school is so different. Uh, alrighty, so for me I'm I'm looking into you know relationship between the LLC and then students wait attitudes

about waste and waste knowledge and some of the other factors I'm looking at are age, gender, school, and their nationality, so I was wondering if, in your experience if any of those factors is the most influential on the program success?
00:19:26

00:19:29
Age, gender, School and nationality.

00:19:33 Speaker 2
About you mean like what they already know about litter and waste, or like how?

00:19:38 Speaker 1
How the yeah, how the LLC changes their waste attitudes and waste knowledge. And if some students are, you know, more receptive. Or yeah, just more impacted by the program.

00:19:56 Speaker 2
I don't really think so, like I think some schools will be starting off from a much lower baseline knowledge than other schools.

00:20:08 Speaker 2
In Ireland, you know, like litter and waste education has been there for a good while now you know there'd be big.

00:20:15 Speaker 2
Answered litter campaigns in towns and things so most kids would know that littering is bad now they might not know exactly why, or you know about the different types of litter in that, but they probably would have come across.

00:20:32 Speaker 2
Come across it at some point like that's why we work a little less campaign. We work with schools that are just starting out on the green Schools program because they're the ones that don't really know too much about it.

00:20:45 Speaker 1
Oh, OK.

00:20:45 Speaker 2
Uhm, like a lot of the other schools.

00:20:49 Speaker 2
In our program, so in Ireland they all start off working on litter and waste for two.

00:20:54 Speaker 2
Years and then they would move on and work on energy conservation and then water conservation and and so on.

00:21:01 Speaker 2
So anyone that's already worked on litter and waste they, you know, they probably kind of have that down and.

00:21:08 Speaker 1
Right?

00:21:09 Speaker 2
And that would be kinda 90% of our schools have already worked through it, so it's actually quite challenging to find schools that haven't done too much on it, but uhm.

00:21:14 Speaker 1
Right, OK?

00:21:19 Speaker 1

00:21:22 Speaker 2
Yeah, I think.

00:21:23 Speaker 2
You know?

00:21:25 Speaker 2
The more disadvantaged schools or smaller schools in kind of rural areas are the ones that probably haven't given too much focus to it before.

00:21:36 Speaker 2
Uhm, so the students might not know as much, whereas if you're in a bigger school most of the time you know with extra funding and things.

00:21:36 Speaker 1
Right?

00:21:45 Speaker 2
Then you know you could be in a state of the art building with, uhm, you know, an amazing system.

00:21:45 Speaker 1
Right?

00:21:52 Speaker 2
But I think they all. Yeah, no. I think I think the hands on experience for the kids and giving them the ownership and making them. You know, look at what's going into the bin or.

00:22:05 Speaker 2
Yeah, set up that system themselves. I think that's the most beneficial thing. Uhm?
00:22:11

00:22:12 Speaker 1
Yeah, yeah, that makes sense.

00:22:15 Speaker 1
Yeah, it's uh, yeah it's curious. I'm sure there's a study on like socioeconomic status of schools and the relationship with informal education, so we don't have that data. But maybe one day.

00:22:32 Speaker 1
And then yeah, I guess a more related to your personal experience as a national operator. What are some challenges that you face and and do you think they're specific to Ireland? There's probably national operator challenges in general, but maybe some more specific ones to your country.

00:22:54 Speaker 2
Uhm, well as I said, so most of our schools will have already gone through the litter and waste team.

00:23:01 Speaker 2
UM, so it's kind of increasingly hard to find ones that that half a nerd that are going to sign up for a little less, UM.

00:23:13 Speaker 2
So it can take a while to recruit them at the start of the year, so that's something. So I usually kind of knock on has a knock on effect on on when everything gets going, you know?

00:23:17 Speaker 1
OK.

00:23:24 Speaker 1
Right?

00:23:25 Speaker 2
And then also that becomes a problem for the knowledge impact survey when I'm trying to find control schools because yeah, like there's very few schools that haven't.

00:23:38 Speaker 2
UM had some kind of litter and waste education already though, but we know also that's kind of difficult and and also, as I said, I think the schools that are really interested are usually the smaller rural schools who could do more with the grant, and those schools could only have.

00:23:43 Speaker 1
Right?

00:23:58 Speaker 2
You know they might only have 2030 forty kids in them, so.

00:24:03 Speaker 2
That's obviously not meeting the the KPI targets for for Mars or whatever in terms of their reach. Bush, like those are the kids that want us and and need it. You know, yeah.

00:24:07 Speaker 1
Right?

00:24:18 Speaker 2
So those would be.

00:24:20 Speaker 2
Kind of the main ones, I think. Uh, maybe we'll just hang for a second if there's anything else.
00:24:30 Speaker 2

No, I think that's kind of. That's kind of the main one. Yeah, it's just that it's like smaller size schools and dumb.

00:24:37 Speaker 1
Right?

00:24:39 Speaker 2
And yeah, getting them, getting them signed up as well. And also you know, like I say, it can look like a lot of stuff. I think at the when.

00:24:49 Speaker 2
When I'm recruiting for the the litter less schools, you know you're kind of saying OK, so you need to.

00:24:54 Speaker 2
Do so, you'll get a €300 grant or whatever it is, but you're also going to have to do 6.

00:24:58 Speaker 1
Right?

00:25:01 Speaker 2
Uhm measurements undo. Three lesson plans and try and do an action day and it can sound like a lot for a teacher to take on at the start of the year when they're probably new to to green schools altogether.

00:25:15 Speaker 2
So yeah, I think it can just be asking a bit much of them sometimes and then when.

00:25:15 Speaker 1
Right?

00:25:20 Speaker 2
They actually do it.

00:25:21 Speaker 2
They're usually fine, but yeah, I think sometimes it can feel like a bit too much of a workload for them to take on.

00:25:29 Speaker 1
Yeah, certainly overwhelming.

00:25:31 Speaker 1
Yeah, yeah, that must be difficult as I guess kind of one of these smaller countries. And then, uh, he's been in the country for quite a while so he really start to limit how many more students you can reach.

00:25:47 Speaker 1
It's kind of a good thing, but.

00:25:50 Speaker 2
Yeah, no, it is a good thing and like I mean there's always more but it's just, you know then you're you're trying to find the teachers who you know are going to follow through for the year as well.
00:25:50 Speaker 1

00:25:59 Speaker 2
You know, like loads of people that sign up for the for the money, but you know, are they actually going to?

00:26:04 Speaker 2
Do the work, yeah.

00:26:08 Speaker 1
Yeah, interesting question. Uh, OK and then.

00:26:15 Speaker 1
Yeah, how yeah, just generally. How do you think the LLC could be improved and anything that stands out?

00:26:29 Speaker 2
No, like I think. I mean, I think it's good. I think it just needs.

00:26:32 Speaker 2
Yeah, well it is pretty flexible, so I think it's just flexibility that teachers need. As I said, I think the six measurements is maybe a few too many like a few years ago we only needed two.
00:26:45 Speaker 1

00:26:46 Speaker 2
Yeah, but I get obviously for the.

00:26:48 Speaker 2
For you to see a clear trend you you need more, but.
00:26:49

00:26:52 Speaker 2
Yeah, I think 6 might be a bit too many, but some of them get it done no problem and and let me think.

00:27:04 Speaker 2
Oh yeah, I find just the timing of the knowledge impact survey can be a bit of an issue because.

00:27:10 Speaker 2
'cause it's usually.

00:27:13 Speaker 2
Coming towards the end of April, UM. And so our schools would usually be on Easter holidays for two weeks, which could be like right before that. Or, you know, in the middle of that or and then an.

00:27:31 Speaker 2
And like you kind of need to give schools a buffer of a week either side of holiday like that, because they'll be doing other activities. You know, right? Or they'll be just settling back in, UM.
00:27:40

00:27:45 Speaker 2
So yeah, and there's usually only kind of a two week window or something to to get that knowledge impact survey join in.

00:27:55 Speaker 2
And like also.

00:27:57 Speaker 2
The summer term, it would be a good time for like schools usually would like to carry out more if they're kind of going out and doing their litter cleanups outside and things like that in the summer term, but the kind is kind of finished.

00:28:12 Speaker 2
By then, you know.

00:28:13 Speaker 2
Right, so that's that's just kind of one of the things that I've come across.

00:28:15
Ah, OK.

00:28:19 Speaker 2
Uhm, that I might be asking them to do the survey and they I might know that they haven't even fully finished the lessons or something yet. You know, OK?

00:28:28 Speaker 1
Right?

00:28:31 Speaker 1
Yeah, so I guess ideal time for that would be like June July for the for the survey.

00:28:39 Speaker 1
Or even later.

00:28:42 Speaker 2
Like even you know, kind of. end of May say because the schools here finish up at the end of June, so you don't want to leave it too late either. But I think, kind of like middle.

00:28:50 Speaker 1
Right?

00:28:50 Speaker 1
Right, OK?

00:28:55 Speaker 2
Middle end of May is probably the best time so that they have a few weeks after the Easter holidays to kind of do that. Bit more.

00:29:04 Speaker 1
Yeah, that makes sense.
00:29:06 Speaker 1
OK, yeah I can relay that to Shimon.

00:29:16 Speaker 1
Then related to COVID, how has that changed how you implement the LLC?

00:29:26 Speaker 2
It hasn't really changed it in a huge way, except obviously that I'm having these online meetings with teachers, uhm?

00:29:36 Speaker 2
Which is actually kind of worked out really well, because they're always spread all over the country, but you just never really would have thought of doing a zoom meeting like two years ago.

00:29:46 Speaker 2
You know she's lost. I think that was done up. So yeah, like I think that's a positive that is has come out of it and.

00:29:57 Speaker 2
But obviously, just the schools were closed for so long, you know, uhm, so they were closed from March until September 2020, and then they were closed from December 2020 until March 2021 again, so like that was a huge amount of time that was lost and.
00:30:01 Speaker 1

00:30:15

00:30:17 Speaker 2
Some teachers did come.

00:30:20 Speaker 2
Sent homework for the students to do, and like I sent them extra resources and they sent those home like kind of little worksheets that the kids could do at home.

00:30:28 Speaker 2
So that was good, but it very much depends on the school. Here, you know schools are kind of left to figure their own way out of doing things.

00:30:40 Speaker 2
Like I'm not sure if that's how it was in all of the countries, but.

00:30:45 Speaker 2
Here you know you could, you couldn't really set up a policy or kind of, you know, I couldn't really say to them.

00:30:51 Speaker 2
OK everyone, here's these worksheets do, because some schools would take a totally different approach to others. You know some would be able to contact the kids and others wouldn't come. Some might not have a computer at home, you know.

00:31:05 Speaker 2
That kind of thing, uhm?
00:31:08 Speaker 2
So yeah, I just think Kobert really took a lot of time out of the program and and yeah.

00:31:16 Speaker 1
Yeah, took away some of those hands on experiences.

00:31:16 Speaker 1
Took away some of those hands on experiences.

00:31:16
Yeah, and so I'm fine.

00:31:22 Speaker 1
Right, OK?

00:31:23 Speaker 2
It was good as well though, like I did. I did get feedback from some teachers saying that they find it grace during COVID because it was like a really nice task that the kids could do and then they felt that they had control over something like they were. You know they had control over the amount.

00:31:40 Speaker 1
OK.

00:31:42 Speaker 2
Of litter in the yard or whatever when they didn't have control over so many other things that were going on on and it was an activity that they could do outside in in groups as well so.

00:31:55 Speaker 2
Those were kind.

00:31:55 Speaker 1
OK.

00:31:56 Speaker 2
Of positives that came out of it.

00:31:58 Speaker 1
Yeah that is interesting. Yeah, I think uh, would you continue some of the COVID activities that teachers did like having kids?

00:32:09 Speaker 1
Do the litter activities at home, that type of thing.

00:32:13 Speaker 2
Yeah, well, I mean, I think I'd provide.

00:32:15 Speaker 2
Them as a resource still.

00:32:18 Speaker 2
Right and then it can be sent home as like a homework thing.
00:32:21 Speaker 2
Or, you know, if we went into another lockdown, it could be done again. But yeah, I think it's good to have as many resources there as possible for the teachers.

00:32:32 Speaker 2

Without being too prescriptive and saying you.

00:32:35 Speaker 2
Have to do this, you know.

00:32:35 Speaker 1
Right?

00:32:37 Speaker 1
Yeah, that flexibility again makes sense.

Appendix I: Interview transcript – Russia

Speaker 1: National Operator in Russia
Speaker 2: Maddy

Speaker 2
Well, so how long have you been working with FEE?

Speaker 1
Uh, with fees since 2002 and what they will see since it started about 10 years ago.

Speaker 2
Oh God.

Speaker 2
OK wow, so you've been involved for a while. Nice and do you. Do you implement other programs besides fee programs?

Speaker 2
Uhm, any other organizations that you work with?

Speaker 1
We look at right now with a number of organizations.

Speaker 1
Uh, for example, key Vault idea network, but as to large scale programs and projects, so there may be mainly those with fee.

Speaker 2
OK, I see.

Speaker 2
Alright, makes sense and and in Russia well so each country for the LLC has to they choose certain waste challenges or topics. Do you? Do you know what topics Russia chose?

Speaker 1
Yes, we prefer during I think last year and.

Speaker 1
Well, last two years we are mainly focused on recyclable waste, recyclable waste.

Speaker 2
OK right, yeah I did notice that in this survey and.

Speaker 2
And then also, I think schools also have a choice. Did that? Did that influence the country choice?

Speaker 1

Uh, yesterday I have a choice, but actually the the idea to focus on recyclable change the waste.

Speaker 1
Because the the regions were interested in that, the schools and the regions were interested in that.

Speaker 2
Is recycling a new or ongoing problem in Russia?

Speaker 1
It's not a problem, it's a I think on because the the state makes efforts to establish.

Speaker 1
Besides, for waste separation, and it's reasonable to go alongside with that and to work with, uh, with students in order to help them in understanding that issue and so on.

Speaker 1
And so forth.

Speaker 2
So yeah, it kind of relates to my next question of whether there are any national policies or initiatives that influence the LLC.

Speaker 1
Yes, we have a document I'm I'm not sure about the date of its issue.

Speaker 1
It is something like sustainable use of resources and.

Speaker 1
And till 2030 and according to that in many regions. Well actually it's obligatory in all regions.

Speaker 1
The speed of implementation is different, but many regions where we have because because the kind of companies we established and now they are collecting different kinds of waste.

Speaker 2
Right.

Speaker 1
It related at schools or collected separately like paper plastic bottles.

Speaker 1
And hazardous waste as batteries. I think they scoped.

Speaker 2
Right, OK, interesting, yeah I'll. I'll have to look into that policy and to check that out.

Speaker 2
Uhm, great and then. So what do you think makes schools join the LLC in Russia? What incentivizes them?

Speaker 1
In general, this topic is.

Speaker 1
Easy to explain.

Speaker 1
Uh, it's feasible. It's easy to reach. Other result.

Speaker 2
Right?.

Speaker 1
Which is also visible.

Speaker 1
We also have kindergarteners on the board. And working with the younger children gets results quicker than with older ones. So samples of kindergartens and primary schools may divide the project which should run during the whole academic, here into subprojects, and they could for example get midway results and show the students there. There are advantages of implementation, for example, of general concept step by step.

Speaker 2
OK, yeah, so yeah, very tangible project, OK.

Speaker 1
Yes, and besides it, it doesn't need any huge investments like for example improvement of water saving systems or whatever, or establishing some renewable sources of energy so these doesn't need any really great financing, right?

Speaker 2
Are there certain types of schools that you see joining the LLC? Like smaller schools? Or is it a diverse range?

Speaker 1
We have all. Got calls from schools, so called small scale in the villages with like 19 students up to large schools with 1500 students in in the cities so.

Speaker 2
OK.

Speaker 1
We have different types.

Speaker 2
OK, interesting and then on the other side of that, what do you think prevents a school from joining? Why wouldn't they want to?

Speaker 1
Actually, it's always good to be part of a big international project. It adds value to small projects and they can see what they can do all together, right? They're networking inside the country and when we have

regional and national events, they can get a general overview of what's going on in the world in that field. I think it's always motivating.

Speaker 2
Yeah, yeah, certainly. Do you have any schools that didn't want to join the litter less campaign?

Speaker 1
And no we don't have. We have a long queue of those who would like to join.

Speaker 2
Oh wow, OK.

Speaker 1
But because of financial reasons, we we have to limit the number of schools.

Speaker 2
Right.

Speaker 2
Yeah, the funding is limited so makes sense. Too bad.

Speaker 2
Uh, OK. And then at the schools, who typically runs the litter less campaign program.

Speaker 1
It's obligatory in Russia that each school or kindergarten have 100% involvement of students. Otherwise, they they will not get the green flag.

Speaker 2
I see OK.

Speaker 1
So that's why they need to arrange the action plan in such a way that each student and even parents and teachers and all kinds of adults are called to contribute to its development.

Speaker 2
OK.

Speaker 1
So for example, we could hardly have the school where each student is able to. Uh, profound research. For example in in the field of weight, recycling or whatever. But they could arrange an exhibition of artworks and everybody could contribute, and if not, at least they could be part of the jury and express which artwork is better and so on and so forth so.

Speaker 2
OK.

Speaker 1
Other schools would be creative to arrange the possibility for everybody to join.
Speaker 2

So, so students are heavily involved. Is there usually a teacher? Or yeah, I guess a teacher or volunteer who usually is organizing these events, or is it all student run?

Speaker 1
According to the legislation, each kind of event at school or any kind of educational establishment in Russia must be organized by a teacher or supervised by a teacher. So we recommend that in addition to the teacher, there are students or parents.

Speaker 2
Right.

Speaker 1
Uh, who could share the responsibility, but officially, for the authorities or the teacher or the director should be responsible.

Speaker 2
OK, makes sense and then at each school do they receive some kind of training or support to help them run the litter less campaign?

Speaker 1
We I have the system of local information and methodological Centers for the program schools program, including LLC. Other heads to the centers usually get the training.

Speaker 1
Or some seminar. Introductory seminar from me, and then they transfer that information to their local networks. Besides, we have lesson plans that were developed in Fear Head off.

Speaker 1
And, uh, we translated. Some of them are relevant for relevant to the chosen topic. Also shared it with them. With them the schools and kindergartens besides, we have a a number of events for best practices sharing.

Speaker 1
So the teachers could. Share without them with others, their best practices and a number of schools. The range also events where students would present their findings and due to online format it's possible to have.

Speaker 1
Common events for several schools and kindergartens.

Speaker 2
Uh-huh OK.

Speaker 2
Is the LLC pretty much the same at each school or does it vary a bit in its implementation?

Speaker 1
They choose the action plan and they compile the action plan according to the needs of the local needs.

Speaker 1

They choose, for example, certain. A kind of waste to work with. For example, one of the kindergartens decided that that they should work with.

Speaker 1
Packaging and especially with Tetra Pak packaging. Yeah and find how to reduce this number. How to reuse it and so on and so forth. And they really developed very interesting approach is shared with the others.

Speaker 1
So it depends.

Speaker 2
OK, yeah.

Speaker 1
Usually they choose the topic to depending on the possibilities of recycling of this or that kind of waste or reducing for example in the cleaner.

Speaker 1
That it's some DC team.
Speaker 1
On the coast of the Baltic Sea. One of the big problems is the plastic that gets into the sea and the world ocean. Well, they were focused on reduction of the number of plastic glasses for water.
And they really made an interesting action plan, and they also carry out activities on the local beach.

Speaker 1
To share their best practices with with people there to prevent the plastic from getting into the ocean.

Speaker 2
Yeah it sounds like students are really heavily involved in Russia. Do you feel that students that they're really impacted by participating in the littlest campaign?

Speaker 1
Yes, actually. Other students. Actually, all organizations, all schools and kindergartens arrange activities in order to influence the local community.

Speaker 1
Especially in the kindergarten, parents are very active in joining and they involve neighbors and so on and so forth. They they really arrange a large scale of events and it's it's really amazing.

Speaker 1
As to schools, the students are very active in. Arranging various activities like flash mobs different activities in social networks.

Speaker 1
And so on and so forth.

Speaker 2
Oh wow, that's really cool. I hadn't thought about that flash mobs and yeah and waste management fun combo.

Speaker 1
Ah, yes, and one of the kindergartens the teachers, arranged flash mob before clean up.

Speaker 1
It was so so nice they send a video, But then later they had to delete it because of you know this personal detail legislation.

Speaker 2
Oh, that's so fun. Yeah, the privacy stuff.

Speaker 2
Oh wow.

Speaker 1
Yes, because it was mentioned that the name of the kindergarten. You know all this.

Speaker 2
OK, yeah.

Speaker 2
Yeah, got to be really careful.

Speaker 2
Uh, well that's awesome. I love that and then, so let's see.

Speaker 2
FEE does an assessment of each program every year. Do you do your own assessment of the littlest campaign in Russia?

Speaker 1
We we participate in this survey every year.

Speaker 2
Of course, yeah.

Speaker 1
So we just. We limit our influence on schools with that because they have a lot of paperwork, so I don't want to overload them with that.
Speaker 2
Right.

Speaker 2
Yeah yeah so OK. And yeah, Russia participates a lot in that survey, so they're doing pretty well with that so.

Speaker 1
Yes, I think I think every time when we have survey Russia is there.

Speaker 2
Yeah, huge numbers. It's a yeah, it really helps. So, uh, OK and then.

Speaker 2

So for my study, I'm yeah. I'm comparing students who have participated in the LLC to students who haven't, and I'm looking at factors like their age, gender, their school and their nationality. And yeah, I was curious if you have any ideas on that? If you think there's a certain factor that impacts a student's understanding of waste.

Speaker 1
You know the age range for the campaign initially was mentioned as from 5 till 12 years old and in Russia it means that students with children of five till seven years old are in the programme.

Speaker 1
Done from 7 till 12, that's cool.

Speaker 1
Uh, that's why this campaign was very helpful for us to.

Speaker 1
Uh, develop closer connections or closer cooperation between kindergartens and schools.

Speaker 1
And sometimes, for example, kindergarten was part of the campaign, but the local school wasn't.

Speaker 1
But anyway, the students in both educational institutions were involved in the activities and of course when we were interviewing students for the survey.

Speaker 2
Right?

Speaker 1
OK.

Speaker 1
It was a bit complicated for us to find the students in the control group for the control group that are not involved at all, so that's why we mainly asked the the kindergardens to to to get in touch with the schools they didn't have any cooperation with and to find the students there.

Speaker 2
Oh, OK.

Speaker 1
Uh, and it was not always successful.

Speaker 1
Uh, because it's much easier for for them to work inside the educational system then for me, for example from outside the educational system to go to school and ask to be a control group.

Speaker 2
Right?
Speaker 2
OK yeah, that makes sense.

In general, at least in Russia. The girls are more active at school in younger age. All the students are the more active the boys are.

Speaker 2
OK.

Speaker 1
But I was surprised to find out that in this particular topic, or mainly because of a really wise approach and creativity of further schools.
Speaker 1
User vote, then genders managed to.
Speaker 1
Find the way of participation and really made great contribution and I think it influenced a lot all of them.

Speaker 2
OK, yeah.

Speaker 2
Yeah, yeah, sometimes sometimes gender has a big effect and sometimes it has absolutely no effect. So it really varies, it's interesting.

Speaker 1
Now they are active in different kinds of activities you know. Or maybe boys are more interested in more practical activities.

Speaker 2
Right.

Speaker 1
You also prefer maybe some more research and at work and so on, I thought so, but in fact, their reality is that they both contribute more or less equally in different kinds of activities.

Speaker 2
Yeah, in different ways. Yeah, that makes that makes sense for sure.

Speaker 2
OK, and then from your personal experience as the national operator, what are some challenges that you've faced and do you think they're specific to Russia?

Speaker 1
Initially 10 years ago it was a bit difficult to explain the local authorities that waste topic is relevant to schools and kindergartens. But now we don't have such a problem, because even in the schoolbooks.

Speaker 1
There are chapters about waste separation or other aspects of waste, waste, recycling and so on and so forth. Initially we had such difficulty, especially for kindergardens. Yeah, and it was a bit difficult also.
Speaker 2
Right?

Speaker 1

Initially, but it was like 20 years ago we had to explain to the parents in the kindergartens, why it's important to deal with such topic?

Speaker 1
Uh, after the first year of work on the topic with the with them, we realized that just the easier we we out it.

Speaker 1
Parents are better to explain them and to help them to be part of the campaign rather than to be the observers away.

Speaker 2
Right, yeah?

Speaker 1
And then it really works.

Speaker 2
Yeah, the participation.

Speaker 2
This goes a long way.

Speaker 2
Interesting welcome.

Speaker 1
Yes, we we arranged one of the contests.

Speaker 1
Under the title, leave for Christmas tree.

Speaker 1
And we suggested that everybody could make an artwork like Christmas Tree of waste material and there was special lamination for pay.

Speaker 1
And really, it really, uh, helped us to change the attitude to to all the topic and they were so active they they were so interested. Yeah, so it was really. That's fine.

Speaker 1
Great thing to do.

Speaker 2
That's very fun. I like that.

Speaker 2
Uhm, well, so it sounds like in Russia, the LLC and other fee programs are really influenced by the national education.

Speaker 2
Would you say that's true?

Speaker 1
Uh, I would say sometimes. Well first, it seems that its Vice versa.

Speaker 1
I mean that sometimes school initiatives influence original aspect which the the schools are free to choose.

Speaker 1
We have no control legislation the school can choose. I think 10% of ours for like a regional component.

Speaker 2
Oh, OK.

Speaker 1
And these students are very interested in this or that topic of the school.

Speaker 1
Could arrange some kind of activities.

Speaker 1
Extra lessons or after school activities in the fields. Interested interesting for children and I would say that waste topic is one of those, uh, that were influenced by children as to national curriculum, you know it's important that.

Speaker 1
Now the activities offered to children.

Speaker 1
Must be in correlation or let's say not in contradiction with the national curriculum. So the schools choose the aspects that are relevant.

Speaker 2
Right?

Speaker 1
Uh, for children and not in contradiction with the school curriculum in order to avoid, you know problems with authorities.

Speaker 2
Right, yeah?

Speaker 2
Of course.

Speaker 1
And I would say that they never see this kind of.

Speaker 1

A combination is quite reasonable.

Speaker 2
OK.

Speaker 2
Interesting, yeah.

Speaker 2
Cool and then.

Speaker 2
So related to COVID, how has a? Yeah, how has the pandemic impacted the implementation of the litter less in Russia?

Speaker 1
A lot of activities were moved to.

Speaker 1
So, uh.

Speaker 1
Two homes

Speaker 1
Two families, for example. Different kinds of.

Speaker 1
Quantus and festivals that we had offline had to be. Yeah, online.

Speaker 1
For example, all the artworks that the students could make at school, they made it home, but it means that our parents and grandparents were much more involved than in normal life.

Speaker 1
We were not able to arrange light scale large scale events like cleanups or some other activities.

Speaker 1
Uh and offline festival, but the positive thing was that we moved to online format and then helped us to connect the schools from all over the country because.

Speaker 1
Some early due to the large.

Speaker 1
Territory of Russia we arranged events for European part fresh and for the Siberian part of Russia. Let's say Asian part of Russia.

Speaker 1
But online activities, seminars, conferences, and all kinds of other activities were open to everybody.

Speaker 1
So maybe for the first time the teachers from the Far East could meet the teacher from clean growth and they listen to each other and ask questions and so on and so on.

Speaker 2
Yeah, that's really nice.

Speaker 1
So there were transient negative things, but also there were some more possibilities we got.

Speaker 2
Yeah that yes. Also. Yeah, bringing having students do things at home. Maybe that also increased the participation of the parents and that probably.

Speaker 2
Is a larger effect on the community I would think.

Speaker 1
Yes, I think so too.

Speaker 1
So because they they had to be involved in in teaching and in studying in everything when those who in after school activities and project work.
Speaker 2
Right.

Speaker 2
Yeah, exactly. They became teachers.

Speaker 2
Yeah, well, let's see here. I just have a couple more questions. How do you think the littlest campaign can be improved in your country or just generally?

Speaker 1
I would love to have it in larger scale.

Speaker 1
Because, as I mentioned earlier, we have a long queue of those who would like to join.

Speaker 2
Yeah, yeah.

Speaker 1
But of course it will cause extra headache in the local regional coordinator.

Speaker 2
Right, yeah, yeah, Russia is so huge. How do you manage that? And that's that's a really big job for one person. You must have a large team.

Speaker 1

Yes, but we have a good team of regional coordinators and so it's easier for me to like I. I work with about 20 people directly and with others indirectly or through different activities when I ah, make presentation or whatever, or when I visit the regions. Of course, I need a lot of people.

Speaker 2
OK.

Speaker 2
Got it. OK so you've got a full regional network, that's good.

Speaker 2
Uh, OK, so larger scale. What do you think about the litter measurement that students do at school? Do you think that there are any improvements that can be made to that activity?

Speaker 1
Uh, I would say that.

Speaker 1
The measurement. They are difficult to understand first of all.

Speaker 2
OK.

Speaker 1
Uh, then the other activities our schools are dealing with. Uh, I'm not really in exactly in correlation with. With that kind of measurements often, though, so they had to rearrange the approach.

Speaker 1
In order to to do something to be measured because it's much more common in Russia that we have, for example, wastepaper collection, which is arranged once in three months every quarter.

Speaker 2
Right.

Speaker 2
OK.

Speaker 1
Or to us. So usually four times a year.

Speaker 1
Uh, and it means that the date is announced and the students bring waste paper from home parents bring it from their offices and so on and so forth and they collect, you know, tone, tons of waste paper and send it to the recycling center.

Speaker 2
Right.

Speaker 1

But if they are asked to measure. Uhm, something? Let's say wastepaper collection 6 times a year. It's difficult to arrange because they also have to take the well into account when it's frosty or they can't arrange such kind of activities, because they're arranged outdoors. If it's rainy, same, you know.

Speaker 2
Yeah, of course.

Speaker 1
Uh, so it it gives. Uh, it gives stricter frame, let's say.

Speaker 1
Uh, and less flexibility for them to to make it images and as to now for example.

Speaker 2
Right.

Speaker 1
Calculating the pieces of waste. Uh in the schoolyard.

Speaker 1
We have a person employed at school who is responsible for cleaning the in that school year.

Speaker 1
And we it's they have to, for example, ask the person not to clean during a week. But it means that in case of local authorities come right, they will have a problem. You know that there is litter. There shouldn't be any leader in the schoolyard.

Speaker 2
Right?

Speaker 2
OK.

Speaker 1
So this causes problems, but they they arranged some activities which widened their viewpoint on waste. For example, one of the kindergartens.

Speaker 1
So I focused on the broken toys.

Speaker 1
Uh, and they tried to reduce that.

Speaker 1
The amount of waste formed by broken toys.

Speaker 2
Oh, OK.

Speaker 1

And they they had they tried to repair some toys or make some artworks of them and so on and so forth. It was an interesting approach, yeah, but it's not something that can be really implemented everywhere.

Speaker 2
Yeah, yeah.

Speaker 2
OK yeah, each school is very unique. Each class is unique, so yeah, it makes it difficult.

Speaker 1
Yes, so sometimes that kind of measurement is mentioned. My favorite for phrase for it is extra headache.

Speaker 1
Extra headache for the teachers I I know that it's important to measure, of course, but sometimes the systems are different.

Speaker 2
Yeah, I think that's something I'd like to.

Speaker 2
One of the recommendations, I think is to yeah, maybe. Find a different system for the litter measurement, because it seems pretty inconsistent. It's not really a reliable measurement, so maybe we can. Yeah, fix that so it's more reliable.

Speaker 1
To my mind, it's it's OK to have, for example, four measurements a year, like once a quarter. It's more or less reasonable and.

Speaker 1
To have at least one criteria or criterion which could be.

Speaker 1
Something calculating.

Speaker 1
Ah, the total amount of waste.

Speaker 1
Uh, collected for recycling, for example.

Speaker 2
Right?

Speaker 1
It doesn't mean that it should increase during the year or decrease.

Speaker 1
Like the criterion could be as much as possible.

Speaker 1
For example, after summer.

Speaker 1
Of course they have more waste paper because it's accumulated during the summer, for example.

Speaker 2
Right?
Speaker 2
Yes Boris yeah.

Speaker 1
And by the by the end of the year as well. But in the middle would be less.

Speaker 2
Right?

Speaker 1
But it doesn't mean that they worked worse.

Speaker 2
Yeah true.

Speaker 1
So it's possible. I think that the most important is really to to calculate the total amount.

Speaker 2
OK yeah, that makes sense.

Speaker 1
Right at least, of course, uh, so we have different countries that have different approaches and so on. But to have one criterion for that kind of measurement, it could be very helpful.

Speaker 2
Yeah, I agree.

Speaker 2
Well, yeah, I'll keep that in mind as we as I keep exploring that.

Speaker 2
So it's a good activity for students, of course, but yeah, would nice to have would be nice to have a good measurement system, so huh?

Speaker 2
OK, well the.

Speaker 2
Last question I have for you is that.

Speaker 2
What do you think makes the litter less campaign successful?

Speaker 2
What's good about it?
Speaker 1
Visible problem, achievable result.

Speaker 1
And international scale.