Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

MASTER THESIS

Master Health Sciences

Evaluation of a learning app prototype on sustainable development that aims to promote students' motivation to act sustainably – A pre-post intervention analysis of data from two schools in Hamburg

Student:

Peggy Klein

Matriculation Number:

[redacted]

First supervisor:

Prof. Dr. Dr. Walter Leal

Second supervisor:

Prof. Dr. Ralf Reintjes

Date of submission:

July 21, 2020

Abstract

Background

In June 2012, the 2030 Agenda for Sustainable Development was adopted by the UN General Assembly. At the core are 17 Sustainable Development Goals (SDGs) which cover the currently most pressing global development challenges that are crucial for the survival of humanity. This thesis aims to analyse whether the use of a digital learning tool concerning the SDGs can promote Hamburg based students' motivation to adopt more sustainable behaviour in everyday life. Attitudes about sustainability and sustainable behaviour in everyday life are investigated, and differences between social status, age and gender will be in focus.

Methodology

To investigate the students' motivation and attitudes towards topics of sustainability, a baseline questionnaire and a follow-up questionnaire were used to evaluate the intervention in a quasi-experimental pre-post design in two schools located in Hamburg. Descriptive statistics were used to identify current attitudes towards selected topics of sustainability as well as the knowledge score on sustainability before and after the intervention, non-parametric related-samples Wilcoxon signed-rank tests were applied to detect changes in attitudes, and Chi-square tests calculated associations among gender and attitudes.

Results

A total of 130 students (mean age 15,21; 46.9% female) were recruited. Significant changes in the perceived importance of monitoring the daily water consumption and healthy nutrition were found in both schools. Significant changes regarding the perceived importance of sustainable action and sustainably produced clothing only occurred in Gymnasium Blankenese. Both schools yielded significant improvements concerning sustainability knowledge score (1.17 95%CI (0.90, 1.45) ($t(129)=8.38$, $p<0.001$) post intervention. Changes in perceived importance and knowledge towards sustainability outcomes were more in favour of higher socio-economic status.

Conclusion

the digital learning tool 'Choiz!' might be able to motivate students to integrate sustainability into their everyday life. Further investigation with the final product of Choiz! is needed to investigate long-term effects.

Table of Contents

List of Tables

List of Figures

List of Abbreviation

MDG	Millennium Development Goals
SDGs	Sustainable Development Goals
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN	United Nations
ESD	Education for sustainable development
GAP	Global Action Programme
DESD	Decade of Education for Sustainable Development
NAP	National Action Plan
GEG	Global Education Guidelines
MEC	Conference of Ministers of Education and Cultural Affairs
MED	Federal Ministry of Economic Cooperation and Development
SES	Socioeconomic status
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
UBA	Federal Environment Agency
SD	Standard deviation

1 Introduction

'Our world as we know it and the future we want are at risk.' António Guterres, Secretary-General

(United Nations, 2019).

Our environment is undergoing rapid, sweeping and long-lasting changes in an unprecedented manner, while at the same time the demographic composition, social and economic structure of our societies are shifting (UNESCO, 2014).
Severe environmental changes, such as the dangers of global warming, the scarcity of natural resources and the loss of biodiversity as well as the extent of worldwide poverty, an increasing restriction of political rights and civil liberties in many parts of the world, wars and threats of terrorism along risks and crises of the financial systems confront us with political, economic, social and ecological challenges (Schreiber & Siege, 2016).

Despite past efforts, there are still several issues of concern from a public health perspective. According to the Sustainable Development Goals (SDGs) Report 2019 (UN, 2019), the world will not manage to end poverty by 2030 and victims of malnutrition increased from 784 million in 2017 to 821 million in 2018. One out of five children and adolescence between 6 and 17 years are not attending school, and at least 200 million girls and women have been subjected to female genital mutilation. In 2017, 785 million people remained without basic drinking water services, and the Climate-related and geophysical disasters claimed an estimated 1.3 million lives between 1998 and 2017. The atmospheric CO2-concentration in 2017 was 146% of pre-industrial levels, ocean acidity has increased by 26% since the pre-industrial level and is expected to rapidly increase by 100–150% by 2100. Besides, the risk of species extinction has worsened by almost 10% over the last 25 years to name but a few grievances (UN, 2019).

Environmental awareness is growing ever more energetic in the younger generation (BMU & UBA, 2018). Every Friday, young people around the globe protest in the streets or online, due to the COVID-19 outbreak, as part of the Fridays for Future movement, and demand climate justice. According to the movement's information, 300.000 people took part in the protests in Germany on March 15 in 2019 (Sommer, Rucht, Haunss, Zajak, 2019).

However, political agreements, financial incentives or technological solutions alone are not enough to target the challenges of sustainable development. A widespread change in the way humans think and act is required (UNESCO, 2014).
To create a fairer, more peaceful and sustainable world, it is crucial to provide and empower all individuals and societies with knowledge, skills unifying values, as well as a greater awareness of the need for change. This is where education plays a crucial role (UNESCO, 2017a).

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), the focus should go beyond literacy and numeracy to learning environments and new approaches to learning for greater justice, social equity and global solidarity. 'Education must be about learning to live on a planet under pressure.' (UNESCO, 2015a).

To date, there is a lack of universally applicable learning material in German language that meets these criteria and requirements even though guidelines and recommendations for Education for Sustainable Development (ESD) exist. Although there are teaching materials, lesson plans or ideas and suggestions on global learning on different learning platforms such as UNICEF (n. d.) and their 'World's Largest Lesson' campaign or EWIK (n. d.)(One World Internet Conference), they are not built upon each other as a coherent learning concept that guides the students through and does justice to the scope of the SDGs.

As the Millennium Development Goals have not been achieved (ATD, 2015 & UN, 2015a), and the Agenda 2030 goals are unlikely to be achieved as projected in the SDG Report 2019, there is an urgent need for action (UN, 2019).
Education can accelerate the achievement of the SDGs (UNESCO, 2014). Although it is a big step forward to integrate the issue of sustainability into the educational background of recent years, effective measures or learning methods are needed to achieve the objectives.
Therefore, it makes sense to develop low-threshold learning materials that are comprehensive, vivid, easy to understand and appealing to the about 85 600 Hamburg students among the 7th and 13th grades of general education schools (BSB, 2019).

In order to make it easier for teachers to select learning materials in the field of ESD in addition to their fixed curriculum, the State Institute for Teacher Training and School Development has set itself the task of developing a digital learning tool that is easily accessible to all and meets the requirements of the German Curriculum Framework Education for Sustainable Development (KMK, BMZ & Engagement Global, 2016).

Since there is a lack of evidence according to behaviour change in students towards sustainability via digital learning material, the main aim of this thesis is to analyse whether the use of a digital learning tool concerning the SDGs is able to promote the motivation to adopt more sustainable behaviour in everyday life of Hamburg students. Also, the attitudes of the students with regard to sustainability and sustainable behaviour in everyday life are investigated, and differences between social status and gender will be investigated.

The following chapter (Chapter 2) will provide theoretical background information about the development of the SDGs, in particular the role of education with a focus on the regulations for the implementation of ESD in Germany. The aims and objectives of the thesis are described in detail in chapter 3. The methodology of the thesis, which includes a quasi-experimental pre-post evaluation of the intervention in a 7^{th}, 10^{th} and 12^{th} grade each at two schools in Hamburg with different social status and the statistical analysis to identify associations between the named topics of concern are described in detail in chapter 4. Subsequently, the results of the investigation are presented in chapter 5, followed by a discussion of the findings related to previous studies, possible explanations for outcomes and the inherent limitations to the thesis a well as recommendation for future research in chapter 6. In closing the conclusion (chapter 7), which attempts to provide clear answers to the raised research questions and to summarise necessary implications as well as the overall contribution of the work. Chapter 8 contains all the references used and Chapter 9 the appendices.

'Education for Sustainable Development (ESD) is the way to a better future for all – and this path starts here and now.'

(UNESCO, 2014).

2 Theoretical background

2.1 Emergence of the Sustainable Development Goals

To combat poverty and climate change, 189 United Nations Member States agreed on eight Millennium Development Goals (MDGs) at the Millennium Summit in 2000, which should have been achieved by 2015. (ADT Fourth World, 2015)

The Eight Millennium Development Goals were:

- to eradicate extreme poverty and hunger;
- to achieve universal primary education;
- to promote gender equality and empower women;
- to reduce child mortality;
- to improve maternal health;
- to combat HIV/AIDS, malaria, and other diseases;
- to ensure environmental sustainability and
- to develop a global partnership for development

(MDG Report 2015).

Despite efforts and sufficient progress, many of the objectives have not been achieved. According to the Millennium Development Goals Report 2015 by the United Nations (2015a), for example, world hunger could not be halved, not all children had access to primary education, girls and women continued to experience disadvantages, infectious diseases such as HIV/AIDS or malaria could not be stopped or combated, environmental resources continued to be destroyed, and the loss of biodiversity could not be contained by the end of the deadline. Nor was it possible to meet the target of 0.7% of gross national income in development aid.

Based on the study by ATD Fourth World 'Challenge 2015: Towards Sustainable Development that Leaves No One behind', the poorest of the world's population could not be reached with the measures.

The first widespread definition of Sustainable Development is included in the Report of the World Commission on Environment and Development: 'Our Common Future' in 1987 and defined as a 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'.

Sustainable development consists of four dimensions - society, environment, culture and economy - which are interwoven and cannot be considered individually (UNESCO, 1987).

It is evident from the findings and the experience gained in the past that further substantial efforts are needed (UN, 2015a).

Followed by the United Nations (UN) Conference on Sustainable Development in Rio de Janeiro in June 2012, the 2030 Agenda for Sustainable Development was adopted by the UN General Assembly. The core of the 2030 Agenda are the 17 Sustainable Development Goals (SDGs) which are universal, transformational and inclusive and should ensure to leave no one behind. These goals cover the currently most pressing global development challenges that are crucial for the survival of humanity. The 17 SDGs aims to secure a sustainable, peaceful as well as prosperous and equitable life for everyone now and in the future (UNESCO, 2017).

A range of social needs such as education, social protection, health and job opportunities are addressed while tackling climate change and environmental protection by environmental limits and critical thresholds for the use of natural resources.

Key systemic barriers of the SDGs to sustainable development are inequality, unsustainable consumption patterns, weak institutional capacity and environmental degradation.

Since the objectives affect the whole of humanity, governments, the private sector, civil society and every human being across the world need to do their part to reach the goals (UNESCO, 2017).

For the implementation of the Agenda 2030, it is expected from governments to take ownership and establish national frameworks, policies and measures.

As the Agenda 2030 are universal and indivisible all countries from the Global South and the Global North are addressed as target countries.

All countries subscribing to it are to align their development efforts to promote prosperity while protecting the planet. Concerning the SDGs, all countries can be considered as developing countries, and all of them must act urgently (UNESCO, 2017).

To provide a brief picture of the 17 SDGs, they are listed below.

1. No Poverty – End poverty in all its forms everywhere
2. Zero Hunger – End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Good Health and Well-Being – Ensure healthy lives and promote well-being for all at all ages
4. Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Gender Equality – Achieve gender equality and empower all women and girls
6. Clean Water and Sanitation – Ensure availability and sustainable management of water and sanitation for all
7. Affordable and Clean Energy – Ensure access to affordable, reliable, sustainable and clean energy for all
8. Decent Work and Economic Growth – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduced Inequalities – Reduce inequality within and among countries
11. Sustainable Cities and Communities – Make cities and human settlements inclusive, safe, resilient and sustainable
12. Responsible Consumption and Production – Ensure sustainable consumption and production patterns
13. Climate Action – Take urgent action to combat climate change and its impacts
14. Life below Water – Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Life on Land – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

16. Peace, Justice and Strong Institutions – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Partnerships for the Goals – Strengthen the means of implementation and revitalize the global partnership for sustainable development

(UNESCO, 2017).

For the successful implementation of the SDGs, one goal is particularly essential, which is outlined next.

2.2 Education – The heart of the Agenda 2030

At the heart of the Agenda 2030 for Sustainable Development is Education (Goal 4). According to Irina Bokova, former *Director-General of UNESCO (2009-2017)*:

'A fundamental change is needed in the way we think about education's role in global development, because it has a catalytic impact on the well-being of individuals and the future of our planet. Now, more than ever, education has a responsibility to be in gear with 21st century challenges and aspirations, and foster the right types of values and skills that will lead to sustainable and inclusive growth, and peaceful living together.'

(UNESCO, 2015a).

Hence, it is to ensure inclusive, opportunity-oriented and high-quality education for all individuals and opportunities for lifelong learning by 2030. The UNESCO (2017) points out that education can accelerate progress towards all SDGs and should, therefore, be part of the strategies for achieving them. It is thus highlighted as a stand-alone goal (UNESCO, 2017). Covered are targets on education under several other SDGs, in particular those on health, growth and employment, sustainable consumption and production and climate change.

Particularly in the area of health, great progress was made, such as the reduction of maternal and child mortality, increased global life expectancy and steady progress in the fight against infectious diseases. Nevertheless, progress in other diseases, such as malaria and tuberculosis, is slowing down (UN, 2019).

Education could, on the one hand, provide more trained health workers, and on the other hand, inform and teach people about good practices for daily life as well as the socio-political-economic dimensions of health and wellbeing in order to improve their standard of living and prevent future health issues (UN, 2019).
The renewed education agenda of this goal is now comprehensive, holistic, ambitious, trend-setting and universal. The vision is an education that changes the lives of individuals, communities and societies, leaving no one behind.

Building on the unachieved Education For All Goals (UNESCO, 2015b) and the education-related MDGs, the Agenda 2030 programme will simultaneously address current and future global and national education challenges effectively. It is based on a humanist vision of education and development founded on the principles of human rights and dignity, social justice, peace, integration and protection, cultural, linguistic and ethnic diversity, and shared responsibility and accountability (UNESCO, 2015a).

These developments resulted in the concept of ESD, the fundamental basis of the learning tool investigated in this thesis, which is addressed in particular by target 4.7 of goal 4 (UNESCO, 2017). According to the UNESCO Roadmap (2014), ESD enables learners to make informed decisions and act responsibly to protect the environment, for economic viability and a fair society for current and future generations, while respecting cultural diversity. It is a lifelong learning process, which is an essential part of quality education. As a holistic and transformative education, ESD considered learning content and outcomes, pedagogy and the learning environment. The purpose is achieved by transforming society (UNESCO, 2014). International discussions and efforts from the past have contributed to the development of ESD, outlined in the next chapter.

2.3 International emergence of Education for Sustainable Development

The UNESCO Roadmap (2014) for implementing the Global Action Programme (GAP) on ESD which ran from 2015 to 2019, aimed to generate and scale-up ESD and to accelerate progress towards sustainable development (UNESCO, 2017).

In accordance with this Roadmap, close links can be drawn between the development of ESD and the international discussions and commitments on Sustainable Development listed in figure 1:

1987 'Our Common Future'
(Report of the World Commission on Environment and Development)

1992 United Conference on Environment and Development
(Rio Summit, Earth Summit) For achieving Sustainable Development chapter 36 of Agenda 21 intensified the international debate on the crucial role of education, training and public awareness

2002 World Summit on Sustainable Development
(Johannesburg-Gipfel, Rio +10) For the first time, a proposal Decade of Education for Sustainable Development (DESD) was included in the implementation plan. The start of the United Nations DESD in 2005 was adopted in the United Nations General Assembly

2012 United Nations Conference on Sustainable Development (Rio +20) The promotion of ESD is decided by the international community. Likewise, ESD has integrated more actively into education, beyond the United Nations DESD (Paragraph 233 'The Future we want')

2013 Global Action Programme on ESD
Commended by the UNESCO General Conference as a follow up to the DESD

2014 Target in the Muscat Agreement des Global Education for All Meeting (GEM). ESD is adapted in the proposal for Sustainable Development Goals (SDGs) by the Open Working Group (OWG)

2014 UNESCO World Conference on ESD
Launch of the Global Action Programme (GAP) in ESD

2015 World Education Forum
(Incheon, Republic of Korea) is expected to take the outcomes of World Conference on ESD into account.

Figure 1: Timetable: Developement of Education for Sustainable Development

2.4 National Action Plan: Implementation of Education for Sustainable Development in Germany

With these developments of the past in mind, the German Sustainability Strategy (Deutsche Nachhaltigkeitsstrategie) was developed based on GAP in 2016.
Concerning education, inclusive, equitable and high-quality education and lifelong learning opportunities for all were provided. This strategy than resulted in the National Action Plan on ESD (Nationaler Aktionsplan Bildung für nachhaltige Entwicklung) in 2017 (BMBF, 2017).

ESD in Germany is both, a governmental and a societal and thus, challenges all parties involved. Based on international agreements of the United Nations, the overarching objective of the GAP is to structurally anchor ESD as an educational concept in schools by 2030 (BMF, 2017).
The National Action Plan (NAP) forms the fundamental basis and orientation for the implementation phase in Germany. The execution of the implementation of ESD in school and extracurricular learning is decided by the ministries, subordinate authorities, seminars and schools of the federal states under their responsibility and authority. Appropriate instruments are, for example, teaching development and implementation of ESD in the internal school curricula, creation of sample curricula, implementation of in-school programs, models and school culture by utilising a whole system approach for a successful transformation process.
Related to already the implemented measures or established instruments, the German Federal Government, the federal states, municipalities and civil society promote and develop cooperation between schools and civil society within the framework of their competence (BMBF, 2017).

The NAP sees the task of the school in empowering future generations to shape their present in respect to their future. For this purpose, sustainable development must be made participatory and inclusive in education processes as well as in everyday life. It is envisaged that the vision of ESD, its plan, strategies and concepts must be developed and supported by everyone in the learning and teaching environment (BMBF, 2017).

The setup and expansion of local and regional educational landscapes are necessary in order to be able to use interfaces and cooperation with extracurricular actors like school support associations, NGOs, economy and ESD-relevant learning locations such as country hostels or educational institutions. This will cause that schools need to open up more internally and externally than before (BMBF, 2017).

2.5 Global education guidelines: The Curriculum Framework for Education for Sustainable Development

To ensure that the quality of education in German schools is the basis for sustainable development at a time of significant global challenges, the 'Global Education Guidelines' (GEG) serve as a guide for teachers.

The GEG is the result of a joint initiative of the Conference of Ministers of Education and Cultural Affairs (MEC) and the Federal Ministry of Economic Cooperation and Development (MED) and is grounded on the GAP, NAP and SDGs. The organisational implementation is carried out by Engagement Global (KMK, BMZ & Engagement Global, 2016).

The learning area of global development is an essential part of ESD and helps to integrate the concept into the school curriculum. With its increased practical orientation, the new edition of the GEG from 2015 aims even more at the school actors and their cooperation partners than the first edition from 2007 (KMK, BMZ & Engagement Global, 2016). It provides a framework for the development of didactic and education plans and school curricula, for the design of teaching and extracurricular activities, for the learning area and subject-specific requirements and their review as well as for the school authority and teacher training.

The overarching educational objective in the field of global development is to acquire fundamental skills for a future-oriented design of private and professional life, for participation in society and for co-responsibility in the global context (KMK, BMZ & Engagement Global, 2016) that are explained further below.

2.5.1 Key Competences for sustainable development

The GEG framework identifies eleven core competencies of ESD in the areas of recognition - evaluation - action, to which the (partial) competences of the subjects relevant to the field of learning refer.

The GEG describes recognition as a targeted acquisition of knowledge. The area of evaluation is about critical reflection and the recognition and weighing of different values as well as identifying development based on value-oriented consideration. Action includes the competence to resolve conflicts and to communicate, to tolerate ambiguity, creativity and readiness to innovate, as well as the ability to participate and co-create in development processes. In particular, the willingness to align one's behaviour with the personal principles of a sustainable way of life is to be harmonized (KMK, BMZ & Engagement Global, 2016).

Table 1 presents the eleven core competencies defined by the GEG in more detail:

Recognition
1. Information processing and processing Obtaining information on issues of globalization and development and processing it on a topic-related basis.
2. Recognising diversity Recognize the socio-cultural and natural diversity in the one world.
3. Analysis of global change Analyse globalization and development processes with the help of the mission statement of sustainable development.
4. Distinction between levels of action Identify levels of action from the individual to the world level in their respective function for development processes**.**
Evaluation
5. Changing perspectives and empathy make one's own and foreign value orientations aware of their importance for the way of life, appreciate and reflect on them
6. Critical reflection and opinion take a stand through critical reflection on globalization and development issues, based on international consensus-building, orientated on the guiding principle of sustainable development and human rights.
7. Assessing development measures acquire approaches for the evaluation of development measures (in our and other parts of the world), taking into account different interests and framework conditions and come to independent assessments.

Action
8. Solidarity and co-responsibility Identify areas of personal co-responsibility for people and the environment and accept them as challenges.
9. Understanding and conflict resolution Contribute to overcoming socio-cultural and interest barriers in communication and cooperation, as well as in conflict resolution.
10. Ability to act in global change Ensure the ability to act in the global change, especially in the personal and professional spheres, through openness and willingness to innovate as well as through an appropriate reduction of complexity. Endure the uncertainty of open situations.
11. Participation and co-creation Students can and are prepared, on the basis of their responsible decision, to pursue sustainable development goals in the private, educational and professional fields and to participate in their implementation at the social and political level.

Table 1: Core competencies of ESD (KMK, BMZ & Engagement Global, 2016, p. 94)

Other Authors such as de Haan (2010), Wiek, Withcombe and Redman (2011) or Rieckmann (2012) have characterized similar key competencies as crucial for promoting sustainable development:

- systems- thinking competence,
- anticipatory competence,
- normative competence,
- strategic competence,
- interpersonal competence,
- collaboration competency,
- critical thinking competency,
- self-awareness competency and
- integrated problem-solving competency.

To discuss them in detail would be beyond the scope of this thesis as the learning material explained later in this investigation underlies the core competencies of the GEG. As outlined in the GEG, the eleven core competencies are characterized by a sharper focus on sustainable development and globalization. Moreover, they are directly connected to competence-oriented education in the field of global learning (KMK, BMZ & Engagement Global, 2016).

However, according to Rieckmann (2013), there is an international consensus on particularly relevant key competences for sustainable development. In a different article he points out that individuals need specific key competences to understand the central problems of world society and how it can be sustainable. Across countries, the competence for networked thinking and dealing with complexity, the competence for forward-looking thinking and for critical thinking are identified as the most important key competences (Rieckmann, 2011).

A holistic, compact learning medium that can be used independently to train all these core competencies, or at least a large part of them, has not yet been developed. The prototype of this thesis to be examined will address all the core competencies mentioned above in the final product as a digital learning app.

2.5.2 The role of education in a digital world

The lives of people who have regularly access to digital devices and virtual worlds have changed significantly in recent decades as the use of digital technologies and the internet have increased around the world (BMBF, 2018). Communication behaviour is fundamentally influenced by the creation of new digital communication and participation opportunities. These developments will bring significant changes and demands in personal, social, and professional life, such as Industry 4.0, the Internet of Things, automation of intelligent behaviour or education 4.0 (BMBF, 2018). Digital media such as tablets, smartphones and whiteboards have also been part of everyday life in schools and universities for a long time (KMK, 2016).

2.5.3 Media in schools – requirements in the educational mission

The MEC sees the digitalization of our world as a process in which digital media and digital tools increasingly take the place of analogue methods, not only by replacing them, but also to open new perspectives in all social, economic and scientific fields (KMK, 2016).

The school's educational mission is essential to prepare students adequately for life in current and future society and to encourage them to participate actively and reactively in the cultural, social, political and professional sectors as well as economic life.
In doing so, social and economic processes of change and new requirements are taken up (KMK, 2016). For the MEC, 'media education in schools' has been a particularly pressing demand in its educational mission since 2012 (KMK, 2016).

The MEC (2016) strategy ‘Education in the digital world’ therefore envisages allowing every student to use a digital learning environment and access to the Internet at all times, if possible until 2021, if this is pedagogically appropriate in the course of the lessons. The MEC points out advantages in digitising of a digital environment in class as digital learning environments help students to organise as a team, develop solutions together, use help on their own and enable immediate feedback. They simplify the organisation and communication of work processes and help to ensure that work materials and intermediate results are documented and available at all times.
In addition to regular classroom learning, the virtual learning and workspace can create learning situations between different learning groups within a school or even between different schools and in extracurricular contexts due to its independence from a fixed schedule and physical presence.
Besides this, digitalisation in schools offers students the opportunity to transfer more responsibility for the design of their learning and thus, to promote their independence (KMK, 2016; Fadel, Bialik & Trilling 2017; Kerres, 2018). However, there are also challenges coming up that need to be addressed.

2.5.4 Chances of Education for Sustainable Development in a digital world

On the one hand, digitalisation offers excellent opportunities to solve global challenges and has the potential to improve access to knowledge and education. On the other hand, the digitisation processes present major challenges, such as the manipulation of facts and information, informational self-determination or the legally secure handling of data and media.

Algorithmic analysis and machine controls are increasingly influencing democratic structures that require self-determination and maturity as an educational goal. To end this, SDG 4 of the Agenda 2030 calls for basic information and communication technology capabilities in SDG 4.4. (BMBF, 2018).

Digital education addresses comprehensively the opportunities and challenges of the digital world, covers the entire academic education and includes areas such as media education, computer science and IT training. The aim is to focus on a technological, social-cultural and application-related perspective.
ESD offers close points of contact in the social-cultural perspective, which examines the interactions of the digitally networked world with individuals and society (BMBF, 2018).

The ability to analyse risks and opportunities for the individual, society and the environment in digital systems is essential. In order to draw conclusions for sustainable development and understanding of algorithms, data and software is required. Their evaluation and potential co-creation are crucial skills for leading an informationally self-determined life in the digitally networked world. The competent application of existing systems can simplify certain learning and work processes and enables the initiation of reflection processes on the complex structure of action with a view to society, environment, individual and protection of privacy (BMBF, 2018).

The MEC's strategy 'Education in the digital world' is an essential pedagogical approach that teaches competent, responsible and creative use of technical applications and also responds to global demands. Digital literacy and ESD have several things in common, such as active participation in society or reflection and analysis.
However, at the 8th MEC/MED conference in 2017, as a result of the workshop ‘ESD and digital literacy’, it was pointed out that ESD competences ‘reflect on values’, ‘change perspectives’, ‘think and act in an inclusive way’ are less emphasised in the MEC strategy (BMBF, 2018).

Since ESD is geared towards the development of competences, action orientation and social participation, it makes sense to complement the MES's strategy with the concept of ESD in order that students develop their attitude based on the skills they have learned, which are relevant for their actions (BMBF, 2018).

According to Baecker (2017) and Kerres (2018), sustainability competences can be encouraged by digital applications and the interconnection of the digital with the analogue. Therefore, a new teaching culture is appropriate and necessary nowadays.

2.5.5 E-learning as a chance for Education for Sustainable development

E-learning is increasingly gaining acceptance in formal and non-formal education (Azeiteiro, Leal Filho & Caeiro, 2014). It is defined as 'an approach to teaching and learning, representing all or parts of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning' (Sangrà, Vlachopoulos & Cabrera et al. 2012). With its proven potential as an effective tool, it can contribute to promoting education for sustainable development (Azeiteiro et al., 2014).

The usage of e-learning and Communication Technologies (ICT) in general deliver many advantages for implementing the SDGs. It offers a lot of content in flexible and different ways and can be adapted for various circumstances and settings. However, the use of the internet and social networks as such has also contributed to the spread of e-learning in the field of sustainable development. This allows e-learning to become more visible in the learning and educational processes. Furthermore, the flexibility of time and space also contributes to increasing usage (Azeiteiro et al., 2014).

The table 2 below from Leal Fhilo in 'E-learning and Sustainable Development (Azeiteiro et al., 2014) summarises the advantages of e-learning as a tool towards ESD:

Item	Advantages
Approach	Action orientated
Focus	Diverse, with an on theoretical elements or practical considerations
Pedagogical nature	Inclusive, with the possibility to achieve pre-set goals
Placement in the curriculum	Flexible, suitable to fit even into pre-defined schedules and time-tables
Methodology	Use of e-media and tools may raise further interest
Student's participation	Actively encouraged with provisions for active learning
Availability of materials	Storage may make materials available to hundreds or thousands of students

Table 2: Advantages of e-learning (Azeiteiro et al., 2014, p. 275)

These advantages can be seen in higher education but can be valid for secondary education as well. He also points out that the use of this method encourages learning engagement and participation, and one of the main barriers to the dissemination of ESD, namely the lack of resources, can be overcome by the help of e-learning. Different materials (e.g. photos, films, texts, tables, etc.) can be used in an integrated and flexible way, creating more active and exciting learning processes.

According to Leal Fhilo (2014), there are also strategic advantages to be named such as flexibility, cost-effectiveness, learner-centred dimension, durability and wide availability of materials suitable for use by a broad audience.

Another advantage is the easy updating or adaptation of online resources overtime to ensure relevance and currency.

Inclusive and open networks, controlled by non-hierarchical structures, enable participants to be both, producers and consumers of knowledge (de Kraker et al., 2013). Sibbel (2014) considers the fusion of emotional, social, cultural and professional perspectives through informal social networking sites to be another key feature.

However, Leal Fhilo (2014) also notes some problems that hamper the processes. These include the fact that not all teachers are familiar with the variety of e-learning methods and tools. This results in missing too many valuable opportunities to expand the use of e-learning concepts in this area. There is also a potential for information overload seen by Sridharan, Deng and Corbitt (2010).

Such limitations must be considered when relying on guided e-learning strategies as part of a sustainability curriculum.

2.5.6 Media use by young people as a resource for e-learning

Digital devices such as smartphones, tablets, computers etc. have become an integral part of young people's lives. Among 12 to 18-year-olds 97 to 98 percent reported to use a smartphone in 2019. This is the result of a representative survey commissioned by the digital association Bitkom among 915 children and young people between the ages of 6 and 18. Almost all children and young people aged 12 to 15 years (95%) and 16 to 18 years (94%) owned a smartphone in the survey year.

According to the study, the internet was the most important medium for young people aged 10 to 18 years to kept up to date with the latest news. In this age group, 76% of them used the web to be informed with current events. Among them, the internet was even more important as a source of information than television, which 64% of the representatives used (BITKOM, 2019). These results show the high availability of resources and the resulting opportunities for e-learning. Alternatively, to put it in a more global context, ‘with more than two-thirds of the world’s population subscribing to mobile, this presents a significant opportunity to educate and raise awareness about the SDGs.’, as Mark Evans, the Senior Marketing Director for Advocacy at the GSMA (Groupe Speciale Mobile Association), said to ITU News about their SDGs in Action App in 2017 (ITU News, 2017).

Therefore, user behaviour can be considered as an advantage to create more awareness about sustainable development. Despite the high availability of resources such as smartphones and tablets, it is vital to ensure that the smaller part of students who do not have access to functional devices are also provided for so that equal opportunities are guaranteed.

2.6 Young people at the centre of shaping a sustainable future

Young people are at the centre of shaping a sustainable future because they are the generation that not only has to live today with the consequences of the decisions of the past but will also bear the brunt of unsustainable development in the future.

Meanwhile, in many emerging countries, young people are clamouring for a stronger say in how societies will live together in the future. The habits they develop now will have a significant impact on future consumption patterns that make them up an essential group in consumer societies. With that, they have the potential to push sustainable development more widely and urgently (UNESCO, 2014).

Not only the organisation 'Fridays for Future' but also greater visibility in the media concerning sustainability are mobilizing a mass of young people towards sustainable development (Sommer et al., 2019).

This is also shown by the development of the long-running Shell Youth Study in 2019 (Shell Jugendstudie) and the study 'Environmental awareness in Germany' (Umweltbewusstsein in Deutschland) by the Federal Environment Agency (UBA) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in its opinion polls (Deutsche Shell Holding GmbH, 2019; BMU & UBA, 2018).

Since 1953, the Shell Youth Study has been financed and published by the oil company Shell at intervals of about four years. In the last opinion poll in 2019, 2572 adolescents and young adults between the ages of 12 and 25 were asked about their life situation and attitudes.

The current survey ‘Youth 2019 – Young people taking the floor’ concluded that pollution is the problem most frightening to mostly three out of four of the young people today, followed by terrorist attacks (66%) and climate change (65%). Environmental protection is an important concern for 71% of those surveyed and is therefore more important than their own high standard of living (63%).

By contrast, in 2002, only 60% of respondents named environmental awareness as the most critical value.

According to the study, a declared increase in the area of political commitment to 34% (comparable values were not mentioned) were observed, which also shows the high level of participation in the Fridays for Future movement (Deutsche Shell Holding GmbH, 2019).
It is also clear that the value orientation concerning a conscious lifestyle was particularly relevant to young women. Four out of five female adolescents considered it important to be environmentally conscious under all circumstances. In contrast, only two out of three male participants agreed (Deutsche Shell Holding GmbH, 2019).

The same was found in the following study, where the female participants were also more environmentally conscious.
The BMU and UBA study on environmental awareness in Germany has been conducted every two years since 1996 to investigate the environmental awareness and environmental behaviour of the German population.
In the most recent survey of 2018, 4038 participants from all age groups and milieus answered questions on environmental policy issues such as mobility, agriculture and energy, as well as relevant stakeholder responsibilities.

The UBA divided the participants into different milieus, which revealed different moods in the individual population strata.
In the younger generation these are divided into *Young Distanced, Young Pragmatists,* and *Young Idealists*, in the older generations into *Precarious Milieus, Bourgeois Mainstream, Critical-Creative Milieus* and *Established Milieus*. The oldest generation is described as *Traditional Milieus* (BMU & UBA 2018), as shown in figure 2:

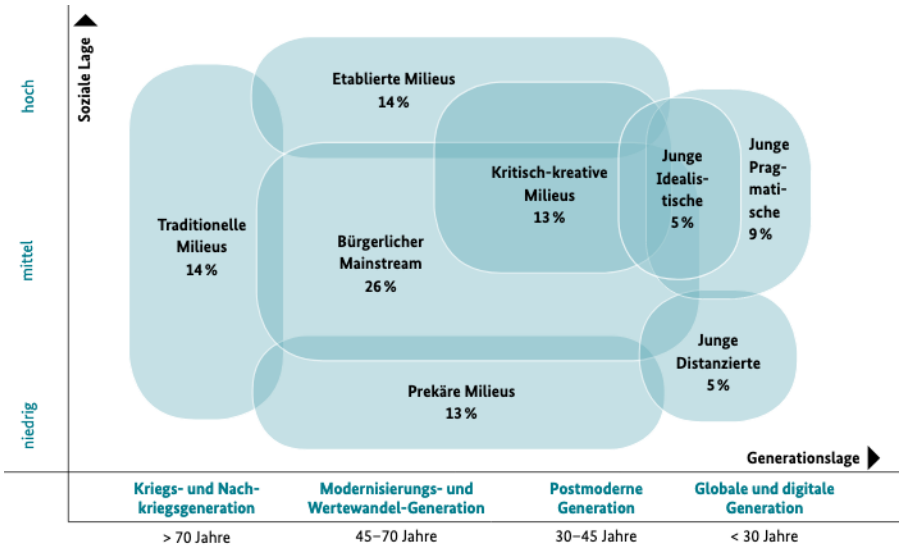

Figure 2: Shares of the social milieus in Germany in the model of socio-dimensions in percent

The results showed that for 78% of 14 to 19-year-olds, environmental and climate protection is one of the most important challenges for Germany. Only issues such as social justice or the state of the education system were narrowly rated as a higher challenge. Compared to 2016, environmental and climate protection has increased by eleven percentage points.

The different moods in the various milieus should be highlighted in this study, since according to the Federal Environment Agency, attitudes to ecological issues vary considerably, even though environmental and climate protection is predominantly seen as a task for the future. They divided young people between 14 to 30 years into three social milieus, the charactaristics of which are described below. These descriptions will be used later in the discussions (chapter 6) and will be related to the experimental groups in this investigation.

The Young Idealists want to live sustainably and make the world a better place. Among them are significantly more young women. Most of them have a high level of formal education, mostly (still) low or no income of their own, but parental homes with above-average incomes in a predominantly metropolitan milieu. They attach great importance to tolerance, respect and diversity.

Sustainability and environmental awareness are essential components of their self-image. They are characterised by a high degree of willingness to be socially and ecologically committed and, if possible, to combine this with their profession. They like to travel, want to get to know the world and make new experiences.
According to the BMU and UBA, the Young Idealists are much more critical of the commitment of the various actors, expect environmental associations for environmental and climate protection and tend to assess the environmental quality as being worse. They assess the contribution that environmental policy can make to the accomplishment of other social tasks as more positive than other milieus.
More than others, this milieu feels that the energy system transformation in Germany is progressing too slowly. They consider environmental and climate protection to be the most crucial task of agriculture much more frequently, just as they name the lowest possible burden on the environment and climate as a priority for the future development of transport.

The Young Pragmatics want to be flexible and seize opportunities. In this group, under 20-year-olds are clearly overrepresented, and there are more young men than women. Most of them have a secondary school leaving certificate, A-levels or are still in school and about a third are employed. Over half of them still live in their parents' house, often with a higher income. For the Young Pragmatics professional success and a good standard of living are essential, and they consider economic growth to be necessary to ensure proper social conditions. Modern technology, cars, clothing in line with the latest fashions and (long-distance) travel are important consumer demands for them, but they are comparatively unconcerned about environmental conditions. The Young Pragmatics are of the conception that environmental and climate protection should also be restricted in order to achieve other goals, or at least that compromises are necessary.

The Young Distanced want to do their own thing as best they can. The gender ratio is a balanced and secondary school leaving certificates and secondary school certificates are overrepresented here. Just under half are in employment with a focus on simple activities.

This group has an above-average number of unemployed people, and consists mainly people with low income, both their own and their parents'. From their point of view, their demands are reduced to the essentials such as housing, clothing, entertainment, cars, and holidays, and they orientate themselves mainly on the price of products. The Young Distanced keep a great distance to political and societal issues. Their environmental behaviour in everyday life is below average. Environment and climate are less of a priority for them in energy, agricultural and transport policy than cost considerations and socially acceptable designs (BMU & BUA, 2018).

In closing, it must be said that the Young Idealists and Young Pragmatics consider the reduction of greenhouse gas emissions through energy system transformation to be of above-average importance. The fact that the opinion of both milieus is well above average shows the overall importance of climate protection for the younger generation and that the majority of young people are interested in sustainability and environmental awareness and see an urgent need for action.

At the same time, the representtives reported dissatisfaction with the offer of environmental communication as environmental issues would not reach them through familiar communication channels. This shows great potential for communication suitable for young people, mainly in the online media especially since they would like to see more commitment in their school or training centre when it comes to dealing with ecological topics in class (UBA, 2016).
The analysis of the target groups and their current attitudes towards sustainability and environmental awareness has resulted in the research questions presented in the next chapter.

3 Aims and objectives

This investigation aims to evaluate whether the use of a digital learning tool named 'Choiz!'concerning the SDGs can promote Hamburg students' motivation to adopt more sustainable behaviour in everyday life by the use of the prototype of Choiz!.

3.1 General objective

The overall objective is to analyse the change in attitudes towards sustainability and the knowledge about the SDGs in the 7^{th} to 13^{th} grades of Hamburg schools in order to encourage students to act sustainably.

3.2 Specific objectives

The specific objectives are seeking:

- To determine the attitude towards sustainable action in the everyday life of Hamburg students.
- To analyse whether the use of the app Choiz! can promote students' motivation to adopt more sustainable behaviour in everyday life.
- To identify whether there are disparities between students with different social index and gender in terms of attitudes and behaviour towards sustainability.

3.3 Research questions

1. Is there an association between the prototype of Choiz! and motivation to adopt more sustainable behaviour in everyday life in Hamburg students?
2. Are there disparities between Hamburg's students with different social index in terms of attitudes towards sustainability and the ability to directly resort to new knowledge?
3. Are there differences in gender in terms of attitudes towards sustainability?

4 Methods

This chapter describes the development of the prototype for the investigation and the methodological approach used to answer the research questions. It gives an overview of the study design and how the data was collected on which the analyses are based, as well as the statistical approach.

4.1 Development of the digital learning material 'Choiz!'

The State Institute for Teacher Training and School Development Hamburg (LI) has set itself the task of meeting the requirements of the GEG, EDW and ESD by developing an appropriate digital learning material which is subject of this thesis (UNESCO, 2014).
As a Service centre of the school and vocational education and training authority the Institution trains and qualifies teachers on a part-time basis and supports schools in Hamburg in the further development of teaching and school quality. The institute advises and accompanies schools as well as the offices of the education and training authority in the implementation of educational guidelines and promotes the realization of pedagogical innovations (LI, 2014).

In the frame of ESD, the LI commissioned a digital learning material in the form of an app called 'Choiz!' which is financed by special funds of the German Federal Ministry for Economic Cooperation and Development and Engagement Global GmbH, a service for development initiatives, and was developed by KB&B - Family Marketing Experts GmbH & Co. KG who are specialised in education communication for children.

The end product of Choiz! covers all SDGs and informs students from the 7th to 13th grade about the impact of their daily decisions and actions while using their creativity and determination to find workable and innovative solutions and alternatives at the same time (LI, 2020). It supports young people to develop sustainable habits and equip them with the key competencies mentioned in chapter 2.5.1. Along the SDGs, the app sensitize, informs and activates students for cognitive, emotional confrontation and concrete psychological action.
Choiz! is designed in a way that promotes the development of the eleven key competences identified by the GEG (KMK, BMZ & Engagement Global, 2016).

The imparted knowledge and facts were composed by pedagogues, scientists and journalists and are playfully brought across via quizzes, estimations, videos, articles, podcasts responding to the reality of the life of the students while meeting the GEG. The knowledge transmitted enables students to recognize and evaluate global challenges. Playing through the application should motivate users to reflect on their behaviour and adopt their attitude. This enables students to take action to shape the future in which they want to live.

Choiz! offers various orientation aids for direct action. On the one hand, the app is equipped with an interactive map of Hamburg or Germany that shows actions related to the SDGs in the user's region. Schools or private persons can place their project on the map, and other users can roll in and participate. All actions on the map are controlled and approved by the agency KB+B.
On the other hand, the pupils also receive various recommendations and work in groups to find solutions for their everyday life at home, at school or during holidays, for example. In this way, the recipients can directly become activists and thus may change their behaviour towards sustainability.

Choiz! has the ambition to be designed by students for students, which is seen as an advantage of the app. To ensure that Choiz! responds to student's reality of life, areas of interests and meet their expectations on the design, a prototype was constructed first. To optimise the end product, regularly consultations and focus groups with representatives of the target group of the 7^{th} to 12^{th} grade of different schools in Hamburg such as Gymnasium Blankenese, district school Otto-Hahn-Schule or district school Wilhelmsburg took place in the development stage.

4.2 The prototype of 'Choiz!'

The Prototype gives insights into SDG 3 – Good Health and Wellbeing, SDG 6 – Clean Water and Sanitation and SDG 12 – Responsible Consumption and Production. It imparts knowledge via some short and appealing articles, quizzes and examinations, gives an overview of the user interface and the action map. Placeholders for videos, podcasts etc. to simulate to the participants how the final product will look like are also included.

This prototype was also used for the investigation of the research questions in this thesis as described below. The results of this work will also be used to compress the final product and may also provide indications as to whether a further financial investment in the project is worthwhile.

4.3 Study Design

In order to answer the research questions, a non-randomised quasi-experimental pre-post intervention was carried out in February and April 2019 under the direction of the LI in the 7th, 10th and 12th grades of two schools in Hamburg – Gymnasium Blankenese and district school Otto-Hahn-Schule Jenfeld. No control group was planned for this quasi-experimental study due to resources constraints. These representatives were selected according to existing characteristics, which are described as follows.

4.4 Sample

As possible, the app should be used in all schools in Hamburg and Germany that aim for general education or the Abitur. The target group of Choiz! is therefore multifaceted. In order to best represent the diversity of future users in the test group, the Gymnasium Blankenese in the west of Hamburg and the district school Otto-Hahn-Schule Jenfeld in the east were selected.

The contrast between the regions of the schools is recorded in the Social Monitoring Report. The Social Monitoring Report of the City of Hamburg has been analysing and describing social, spatial development annually since 2010 in order to determine social, spatial differences within the city and identify districts potentially in need. For this purpose, the city is divided into 941 statistical areas.

This Social Monitoring considers the following indicators of interest: Children and adolescents with a migrant background, children of single parents, recipients of unemployment benefit, recipients of AsylbLG (Asylbewerbersleistungsgesetz), unemployment, children living in families with minimum income, minimum income in old age and school-leaving qualifications.

An index was applied to assign a social status (high, medium, low and very low) to each statistical area (Freie und Hansestadt Hamburg, 2019).

The results of the report showed considerable differences in the status of citizens in Blankenese and Jenfeld, which makes the experimental group a diverse group that could represent the target audience.
According to the Social Monitoring Report 2019, the district of Blankenese had six statistical areas, each with high status. By contrast, the district of Jenfeld had four statistical areas with very low status and three statistical areas with a low status. Only one statistical area had a medium status (Freie und Hansestadt Hamburg, 2019).

The following table 3 shows selected indicators of the Statistical Office for Hamburg and Schleswig-Holstein. A clear difference between the two districts is seen in the share of under-18s with a migrant background, the share of recipients of unemployment benefit II and the use of social housing (Statistisches Amt für Hamburg und Schleswig-Holstein, 2018a & b).

	Blankenese	Jenfeld	Hamburg
Population	13.686	27.084	1.891.810
Under age of 18	2.532 (18.5%)	5.307 (19.6%)	309.905 (16.4%)
Under 18 migration background	663 (26.3%)	4.082 (77.5%)	160.667 (52.0%)
Employees subject to social insurance	3747 (47.9%)	9066 (50.7%)	762.480 (59.3%)
recipients of unemployment benefit II	162 (1,2%)	5.179 (20.9%)	187.384 (9.9%)
Social housing	48 (0,7%)	1400 (12,3%)	75.716(7.9%)

Table 3: Hamburg district profiles – reporting year 2018

These results are also consistent with the classification of the Hamburger Social Index, also named 'KESS-Index'. The Social Index is a measure of social burden of schools in Hamburg.

It describes the social composition of the pupils by a scale from 1 - 6: If most of the students come from an educationally remote and socially challenged family home, the school has a social index of 1. Hence, if the pupils come mainly from educational and affluent backgrounds, the school gets a social index of 6. Depending on this, schools in Hamburg receive more or less financial aid to ensure fair support. Beyond that, the measurement allows a fair comparison of the learning level results by comparing those schools that work under similar social conditions (Schulte, Hartig, Pietsch, n.d.).

The inclusive district school Otto-Hahn-Schule in Jenfeld was last classified in 2009/2010 with a social index of 2, while Gymnasium Blankenese had reached the highest grade of 6 in 2013/2014 (Bürgerschaft der Freien und Hansestadt Hamburg, 2018).

Figure 3: Locations of the school. Map basis: Urban area Hamburg (online), Google Maps for Firefox, © GeoBasis-DE/BKG 2009, URL: https://www.google.de/maps/@53.5768361,10.0230205,11.44z

4.5 Sample size

In the 2018/2019 school year in Hamburg, there were 85 569 pupils in the 7th to 13th grades of the general education schools (BSB, 2019) which were considered as target groups for the app Choiz!. The required sample size of 383 participants was calculated based on a confidence interval of 95%, a type I error of 5 % and an estimated population proportion of 50% with the OpenEpi calculation tool Version 3.01.

This describes the minimum number of participants, but if a drop-out rate of 10% was taken into account, the estimated sample would be 421 respondents.

4.6 Procedure

It was first examined whether an application to the ethics committee was necessary for the project. After consultation with the current chairman of the CCG Ethics Committee, and head of the Research and Transfer Centre Application of Life Sciences, an ethics application was deemed not necessary. The chairman of the CCG estimated the measures as unproblematic and pointed out that there was no obligation by the Hamburg University of Applied Science to undertake an ethical application by that time. All participants involved provided a written declaration of consents of their parents or guardians. Questionnaire data were handed out in paper form and collected in envelopes. The Evaluation included a baseline questionnaire (A) and one follow-up questionnaire (B) carried out immediately after the intervention.

4.6.1 Implementation

The investigation in the 7th grade of Gymnasium Blankenese took place on the 7th February 2019 and also in a 10th and 12th grade on the 25th February. The same set up was carried out at district school Otto-Hahn-Schule in Jenfeld on the 24th April in all three grade leves. The project manager of Choiz! (state coordinator for ESD) arranged appointments with the participants at Gymnasium Blankenese while the advisor on human rights and anti-democracy at LI delegated the appointment at district school Otto-Hahn-Schule in Jenfeld.

After a warm welcome, the collection of the consent declarations and a short introduction to the SDGs, questionnaire A was handed out. It contained detailed instructions for the students on how to proceed with the implementation. These were read out loud by a student. Afterwards, any questions about the procedure could be asked.

Once the students had completed questionnaire A, the researcher collected them and guided the participants through the prototype while encouraging them to participate actively. Afterwards, questionnaire B was completed with the gained knowledge.

Particular attention was paid by the researcher to ensure that the procedure was always carried out under the same conditions in order to remain comparable and thus provide valid and reliable results. Besides, there were pedagogical assistants in Jenfeld who supported pupils with language barriers or difficulties in understanding.

All in all, 90 minutes were set for the investigation in order not to overstrain the capacity of the curriculum. Time management can be seen in the figure below.

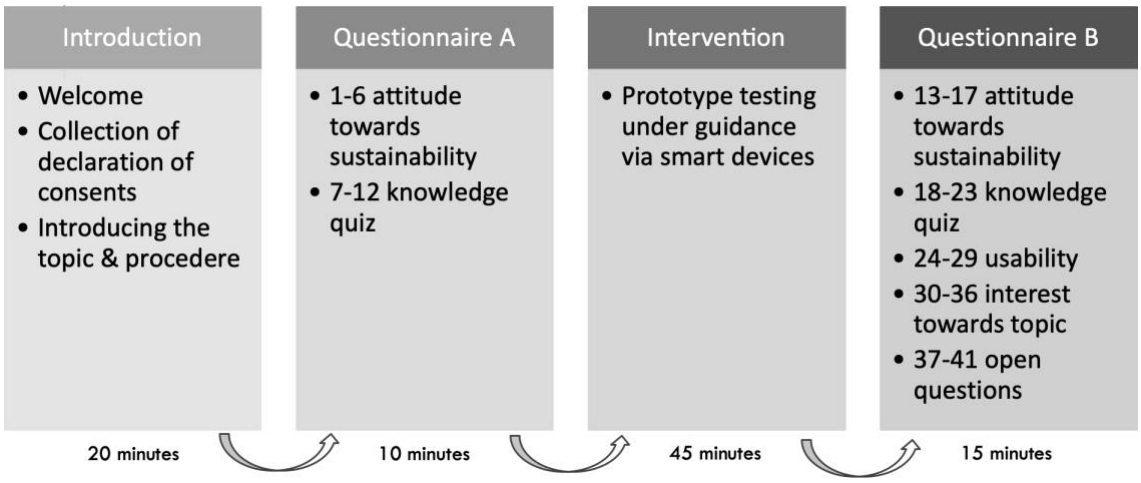

Figure 4: Overview of the procedure

All questionnaires are collected in envelopes right after completing them and then evaluated by the researcher as described hereafter.

4.7 Measures

The data was collected by two self-administered questionnaires (A & B) which consists of 41 items in total, specifically designed to answer the research questions. Questionnaire A was conducted at baseline, while questionnaire B was applied right after the intervention as a follow-up for the evaluation process. The conducted questionnaires covered various topics of interest beyond the subjects of the research questions. For answering the research questions, not all items from the questionnaires are used. The items used are described in more detail in the results section (Chapter 5). Both questionnaires are attached in Appendix I and II.

The questionnaires were anonymous, but the participants were asked to define a pseudonym consisting of a colour and an animal to observe changes in individuals without identifying an individual.
Data has been treated confidentially in compliance with the applicable data protection regulations and has not been passed on to third parties. The questionnaire results were evaluated exclusively in summary form and therefore, do not allow conclusions to be drawn about individual persons. All Questionnaires were erased six months after the intervention.

4.7.1 Questionnaire A

Besides the query of age and gender, questionnaire A (Appendix I) consisted of two sections which comprised eleven questions in total:
The *first section* contained one question to break the ice and five questions to assess the participants' attitudes towards water consumption, healthy nutrition, sustainable action and sustainable production of groceries and clothing.

The *second section* included six knowledge questions related to the content of the prototype to test their current knowledge concerning virtual water, water consumption in Germany, categories of water quantity for the manufacture of clothing, water consumption of meat production, the sugar content of certain foods and wages of a textile worker in Bangladesh.

4.7.2 Questionnaire B

Questionnaire B (Appendix II) comprised 29 questions divided into five sections.
The First section started with the same four questions of questionnaire A towards the current attitudes of the named topics water consumption, healthy nutrition, sustainable action and sustainable production of groceries and clothing in order to determine possible changes of attitude after the investigation.

In *the second section,* the same knowledge assessment was queried to identify possible gain in knowledge after the investigation.

The third section was addressed to ask the participants to rank the usability, structure and comprehensibility of the app in order to adapt possible optimisations in the final product by KB+B Family Marketing Experts.
The fourth section was addressed to examine the target audience's interest in the topic of sustainability, SDGs and in using an app to take sustainable action.

The *fifth section* allowed the participants the opportunity to express their motivation to use the app, what they liked and disliked, proposed amendments as well as additional requests.

All questions except the knowledge assessments and open questions were ranked via a 4-point Likert Scale ('strongly agree', 'agree', 'disagree', 'strongly disagree'). As a clear tendency of the participants was requested, the 4-point Likert Scale was used to avoid abstentions, which were then dichotomised into a positive (strongly agree & agree) and a negative (disagree & strongly disagree) characteristic for the descriptive results. The knowledge assessment was also dichotomised into the sum of correct answers and false answers, respectively. Sum scores of the variables split by schools and grades were built in order to draw comparisons.

4.8 Statistical analysis

Questionnaire data were analysed using IBM SPSS Statistics version 24. The syntax of the statistical analysis is displayed in Appendix III. When no box was ticked, the measures were categorised as missing. The Missing values were retained in the data set and included in calculations of proportions. The number of missing values for each variable is reported next to the results. The characteristics of the sample were described with mean values and standard deviations (SD) and, where relevant, absolute frequencies and proportions.

In order to analyse the status quo in terms of attitudes and knowledge on the topic, descriptive statistics, absolute frequencies and proportions of questionnaire A were determined.
To detect significant changes in the attitudes of the target audience in questionnaire A and B to answer the first research question, non-parametric related-samples Wilcoxon

signed-rank tests split by grade and school were performed and the effect size ‘r’ was determined using Cohen’s Benchmark. The formula used for the effect size was:

$$r = \frac{z}{\sqrt{N}}$$

Where ‘r’ stands for the effect size to be calculated, ‘z’ is the z-scores, and ‘N’ is the number of complete observations. The effect size is categorised by Cohen (1992) as follows:

- Small effect: r = 0.10
- Medium effect: r = 0.30
- Large effect: r = 0.50

Variations in the behaviour and attitudes, as well as the outcomes of the knowledge test of students with different social indexes, were determined by comparing the results of both schools to address the second research question.
For this purpose, the number of correct answers was tested utilising two t-tests split by the school.

To answer the third research question, the relationships amomg the gender and their attitudes were evaluated using Chi-square tests with Cramér's V. This involved comparing the responses of girls and boys in terms of perceived importance of monitoring the daily water consumption, healthy diet, sustainable action, sustainably produced food and the perceived importance of sustainably produced clothing.
Knowing that there are more than two gender identifications, the analyses have nevertheless been reduced to female and male for the statistical claim. However, every one of the representatives seemed to find themselves in the two gender identifications.

5 Results

The sample consisted of 130 students, with 64 students from Gymnasium Blankenese and 66 students from the district school Otto-Hahn-Schule in Jenfeld of the distribution of females and males was balanced with 46.9% (n=61) females and 53.1% (n=69) males. The mean age of the sample was 15.21 with an SD of 2.03 and ranged between 12 and 20 years. Figure 5 shows the distribution of age with the sample in a histogram.

The participants in the 7th grades were between twelve to 14 years old, in the 10th grades between 15 to 17 years and the participants in the 12th grades were between 17 to 20 years old.

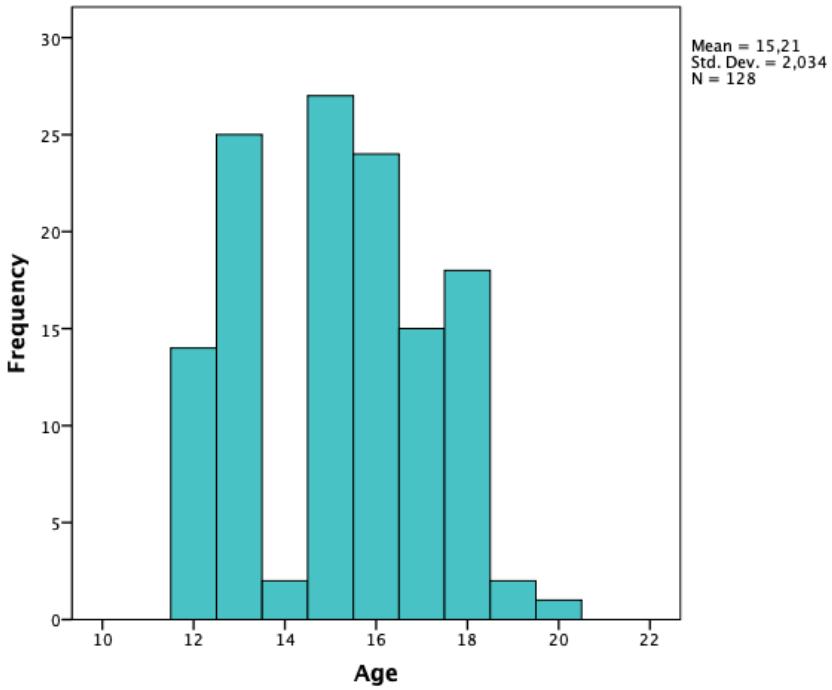

Figure 5: Age histogram (n=128)

In the following results of the knowledge assessment and the attitude towards sustainability assessment will be presented.

With respect to the scope of the research questions, only selected items of the questionnaire were used for the analysis. From questionnaire A (Appendix I) the outcomes of items 2 - 6 and the sum of correct answers from the knowledge test (items 7-12) are used. Additionally, results of items 12-17, the sum of correct answers from the knowledge assessment (items 18-23) as well as items 30, 31, 33 and 34 of questionnaire B (Appendix II) are applied as displayed hereafter:

- Perceived importance of monitoring the daily water consumption (items 2 & 12),
- Perceived importance of a healthy nutrition (items 3 & 14),
- Perceived importance of sustainable action (items 4 & 15),
- Perceived importance of sustainably produced food (items 5 & 16),
- Perceived importance of sustainably produced clothing (items 6 & 17),
- 'Most of the water we use every day is virtual water. What is meant by this?' (items 7 & 18),
- 'What is our virtual water consumption in Germany per person/day?' (items 8 & 19),
- 'In order to calculate the amount of water used to produce our products, experts use three categories: Which definition describes 'grey water'?' (items 9 & 20),
- 'How much virtual water is used for one kg of beef? '(items 10 & 21,)
- 'Which food contains more sugar?' (items 11 & 22),
- 'How much does a person who makes T-shirts earn per month in Bangladesh?' (items 12 & 23),
- 'I am interested in finding out more about sustainability.' (item 30),
- 'I am interested in learning more about the sustainability goals.' (item 31),
- 'Could you imagine that using the end product contributes to sustainable behaviour? (item 33) and
- 'I would also use the app in my free time.' (item 34).

5.1 Comparison of attitude change through pre-post-analysis

The results of the opinion poll before and after the intervention are described further below. In order to identify more clear tendencies, the answer options 'strongly agree' and 'agree' were combined into a positive expression, while 'disagree' and 'strongly disagree' were grouped as a negative expression. In order to get an overview of the response distribution concerning all four categories of the Likert Scale, additional graphics alongside the results illustrate the responses divided by school and grades. The negative expression is displayed in sand colours and the positive expression in turquoise colours.

5.1.1 Perceived importance of monitoring the daily water consumption

The importance of monitoring their daily water consumption was not a topic of concern for the majority (54.1%) of Blankenese's 7th grade at baseline. Similar results were shown in the 10th grade as even 65.2% considered it not important to monitor their daily water consumption. However, in the 12th grade, more than half of the students (52.9%) perceived this topic.

In Jenfeld, 83.3% of the 7th grade, 64.5% of the 10th grade and 58,9% of the 12th grade were not aware of their daily water consumption at baseline. There seems to be a tendency of increasing perceived importance with increasing age. All in all, the students in Blankenese seemed to have a higher awareness of the issue. Figure 6 presents the percentage distribution of the 4-point Likert Scale ranking split by school and grade:

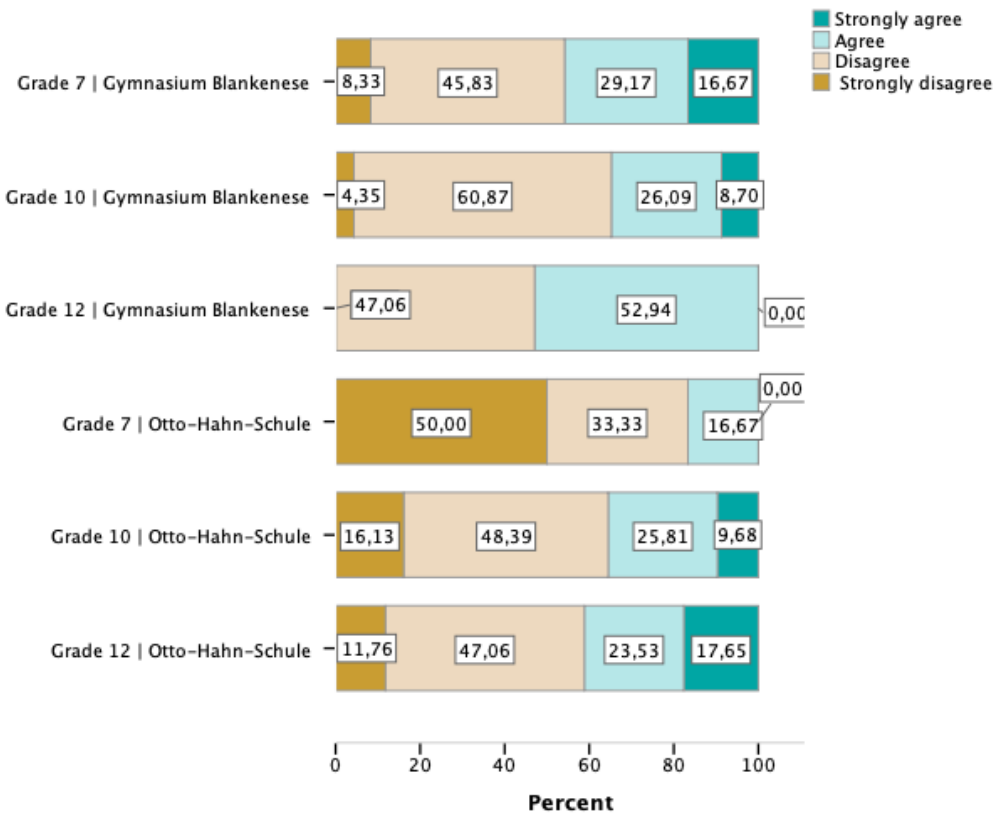

Figure 6: ‚It is important to me to pay attention to my daily water consumption.' (n=130)

5.1.2 Change in perceived importance of monitoring daily water consumption

After the intervention, the number of young people who consider it important to monitor their daily water consumption rose from 45.9% to 66.7% in the 7th grade, from 34.8% to 82.6% in the 10th grade and from 52.9% to 94.1% in the 12th grade. In the before (Mdn=3.00) and after (Mdn=3.00) comparison, the attitude towards the relevance of monitoring daily water consumption has risen significantly with a medium effect concerning to the Cohen's Benchmark z=-4.79, p=0.000, r=-0.42.

In Jenfeld, the perceived importance grew from 16.7% to 38.9% in the 7th grade, from 35.5% to 71.0% in the 10th grade and from 41.1% to 70.6% in the 12th grade. The awareness also increased significantly in this group comparing before (Mdn=3.00) and after (Mdn=3.00), z=-4.00, p=0.000, r=-0.25 but with a small change.

Contrasting the attitude towards paying attention to their daily water consumption prior to the intervention (Mdn = 2.00), the rate of both groups together increased significantly after the intervention (Mdn=3.00), z=-6.20, p=0.000, r=-0.38. These results represent a medium change in awareness. The percentage distribution of the 4-point Likert Scale ranking split by school and grade is demonstrated in figure 7:

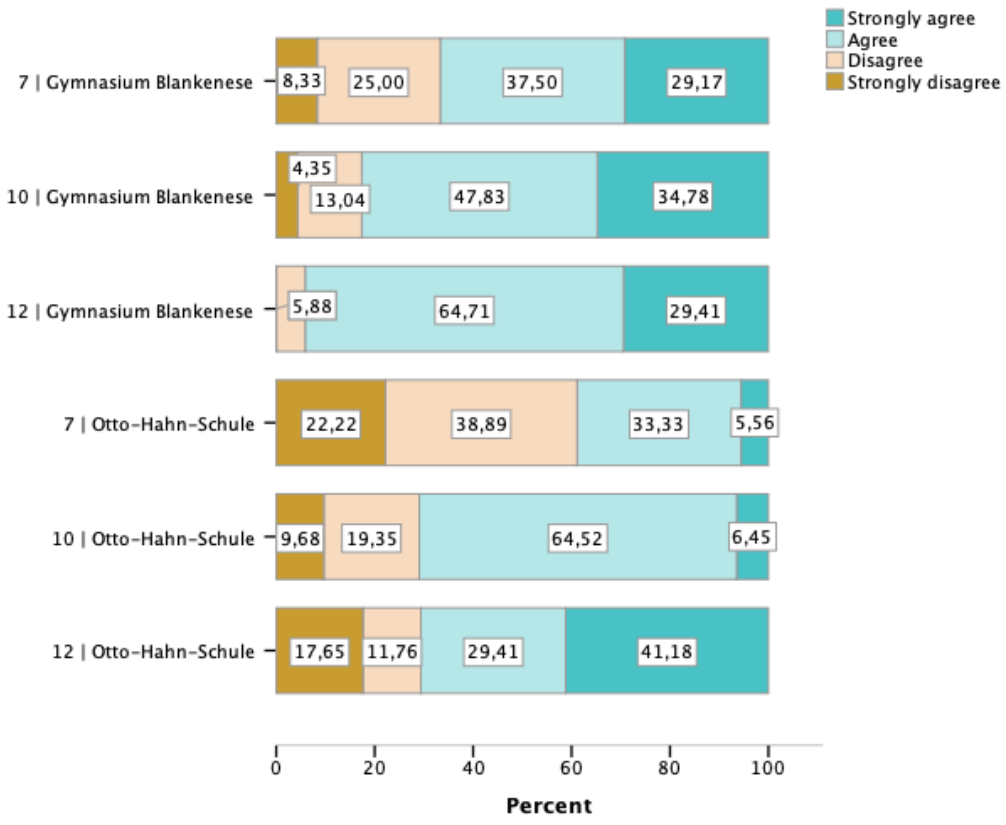

Figure 7: ‚In the future, it is important to me to pay attention to my daily water consumption.' (n=130)

5.1.3 Perceived importance of healthy nutrition

In Blankenese's 7th grade, 75.0% of the students believed that a healthy diet is important, 82.6% in the 10th grade and even 93.8% in the 12th grade. There appears to be a tendency between age and perceived importance of a healthy diet in this school.

A different picture emerged in Jenfeld, as 55.6% (44.4%) of the 7th grade did not believe that a healthy diet is essential. However, the participants who believed in the importance of healthy eating increased with age to 56.7% in 10th grade and 58.8% in 12th grade. Figure 8 shows the percentage distribution of the 4-point Likert Scale ranking split by school and grade:

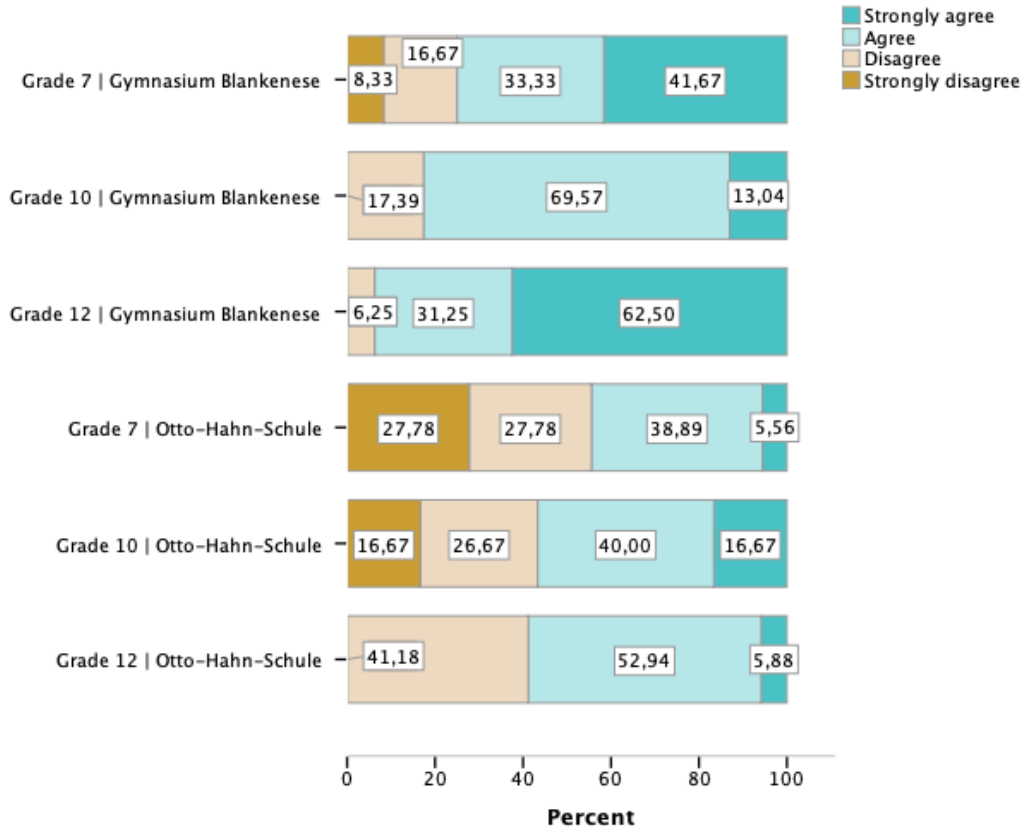

Figure 8: ‚A healthy diet in everyday life is important to me.'(n=128)

5.1.4 Change in perceived importance of healthy nutrition

Among the high school students, the biggest change of attitude towards a healthy diet was seen in 7th graders from 75.0% to 87.5%. There was a slight drop from 82.6% to 78.3% for the 10th graders and a marginal improvement from 93.8% to 94.1% for the 12th graders. For these students, the relevance of the topic was significantly higher after the intervention (Mdn=3.00) than before (Mdn=3.00), z=-2.50, p=0.12, r=-0.22 but with a small effect.

Among the students of the district school, there was an opinion change in each group regarding the relevance of healthy nutrition. The 7th graders climbed from 55.5% to 66.7%, the 10th graders from 56.7% to 74.2% and the 12th graders from 58.8% to 70.6%. These results were significantly higher after the intervention (Mdn=3.00) than before (Mdn=3.00), z=-2.89, p=0.04, r=-0.25 and were showing a small effect size also.

Considering the entire audience, the importance of healthy eating was significantly higher after the Intervention (Mdn=3.00) than before (Mdn=3.00), z=-3.76, p=0.000, r=-0.23. These results demonstrated a small effect. The percentage distribution of the 4-point Likert Scale ranking split by school and grade is shown in figure 9:

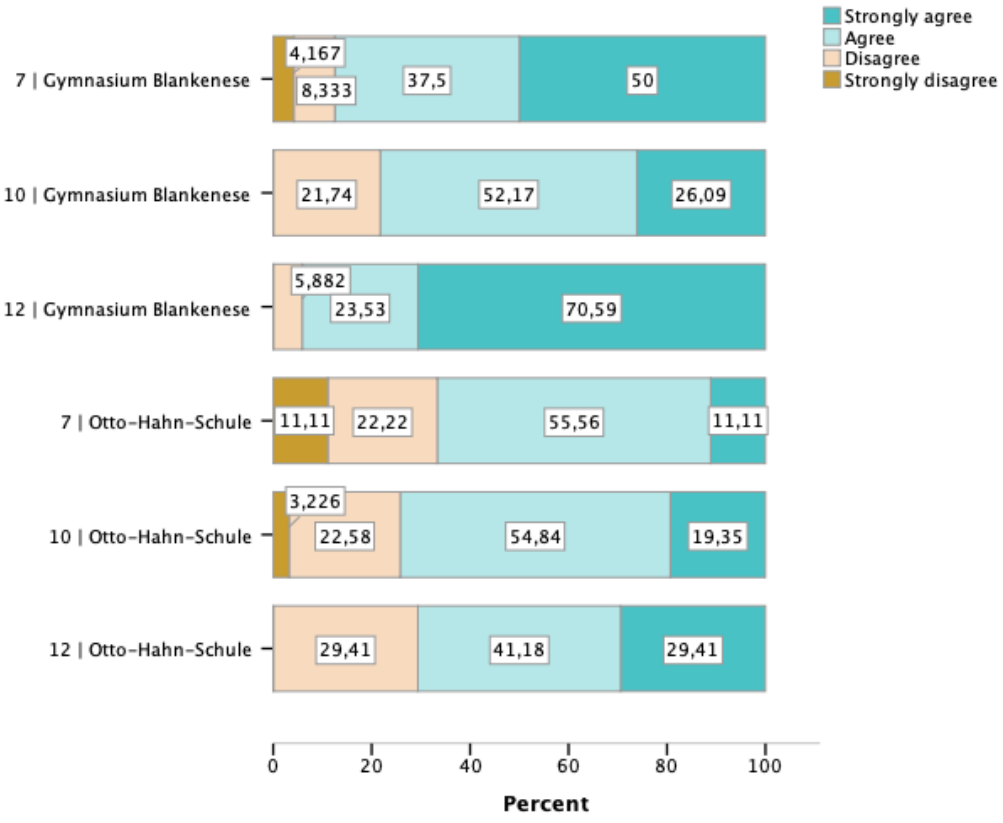

Figure 9: ‚In the future, a healthy diet in everyday life will be important to me.' (n=130)

5.1.5 Perceived importance of acting sustainably

For the majority of high school students, it is important to act sustainably. With increasing age, the perceived importance of sustainable action rose from 62.5% in the 7th grade, 78.2% in the 10th grade to 82.3% in the 12th grade.

The positive attitude towards sustainable action in the district school is also associated with growing age. But sustainable action is less important for the majority (55.5%) of the 7th grade. However, more than a half of the 10th (56.7%) and 12th (66.6%) grades agree on the importance of sustainable action. To sum up, it seems to be less relevant for the district school students than for the high school students. Figure 10 shows the percentage distribution of the 4-point Likert Scale ranking split by school and grade:

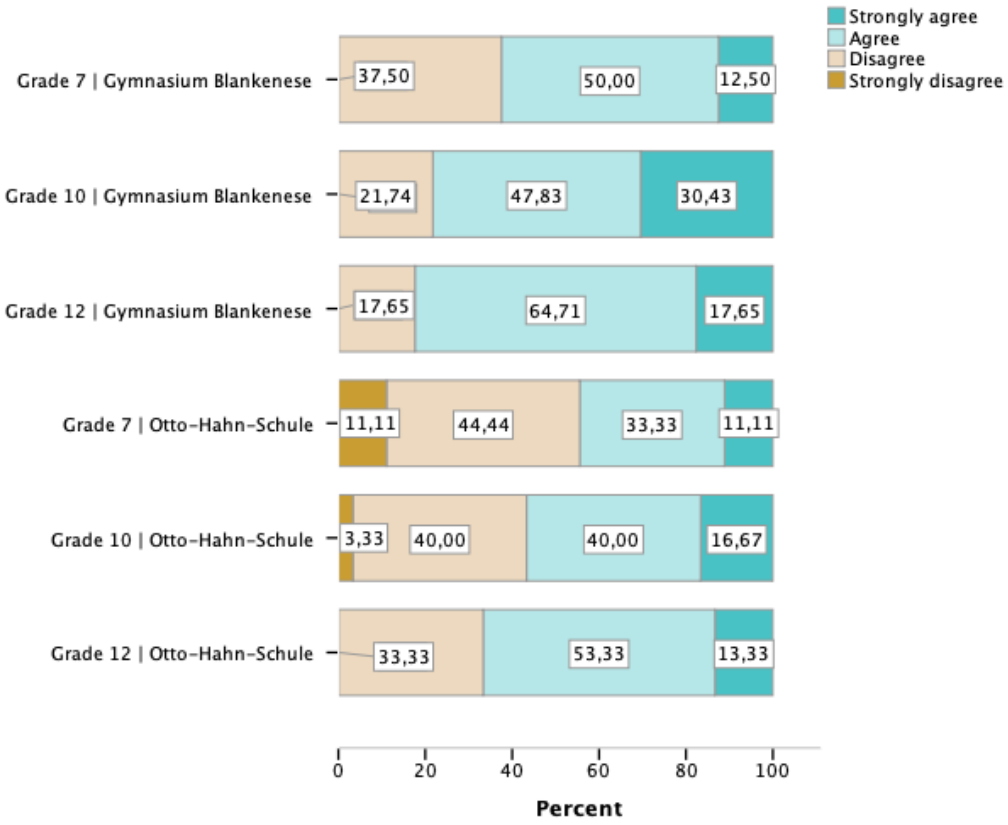

Figure 10: ‚Sustainable action in everyday life is important to me.' (n=127)

5.1.6 Change in perceived importance of acting sustainably

Regarding the relevance to act sustainably the biggest change was in the 7th grade, rising from 62.5% of agreement to 83.4% of agreement, whereas the 10th grade gained from 78.2% to 91.3% and the 12th grade from 82.3% to 94.1%. These results reflected a significant change with a small effect (Mdn=3.00), z=-2.45, p<0.05, r=-0.21.

In Contrast, the results in Jenfeld of the 7th graders rose from 44.4% to 50%, the results of the 10th fell from 56.7% to 48.4%. In the 12th grade again, there was an improvement from 66.6% to 70.6%. No significant changes were seen in this school (Mdn=3.00), z=-0.39, p>0.05, r=-0.03.

Consequently, no significant changes occurred in pre-post comparison when both groups were combined (Mdn=3.00), z=-1.41, p>0.05, r=0.09. To support these outcomes, no effect is seen. The percentage distribution of the 4-point Likert Scale ranking split by school and grade is demonstrated in figure 11:

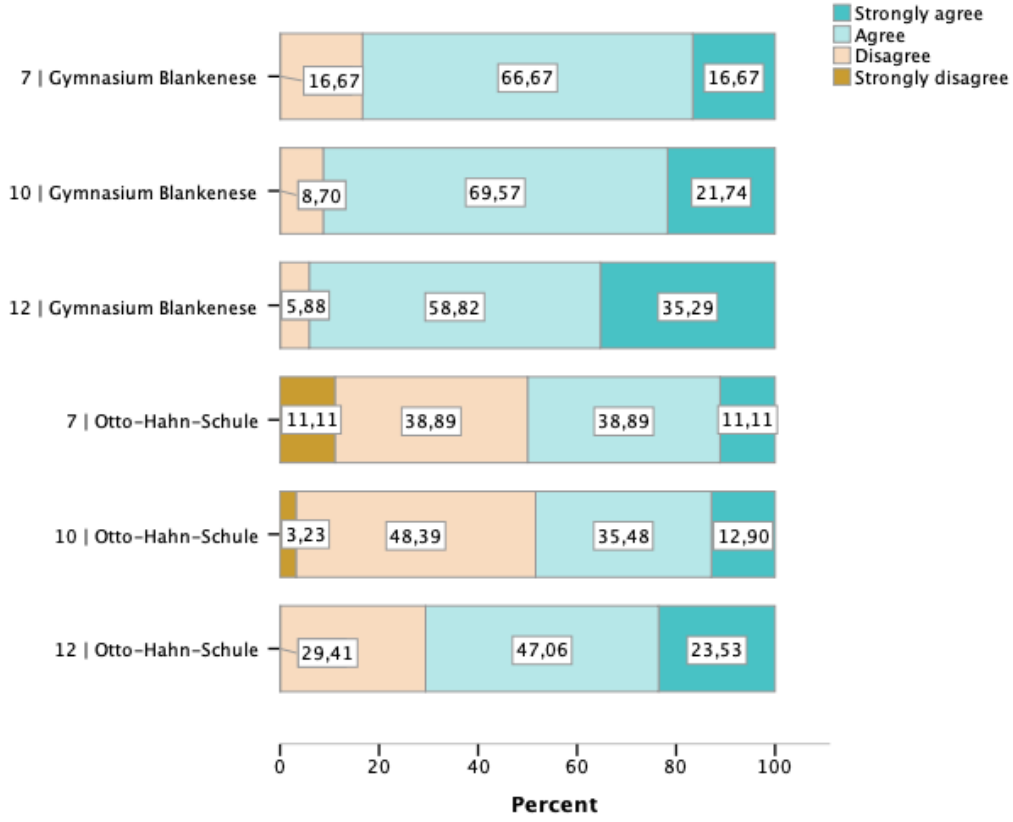

Figure 11: 'In the future, sustainable action in everyday life is important to me.' (n=130)

5.1.7 Perceived importance of sustainable food production

Concerning sustainable food production, the majority of both schools recognised the significance of this issue. This view was shared by 83.3% of Blankenese's students in grade 7, 82.6% in grade 10 and 94.1% in grade 12.

In Jenfeld, the students attached less importance to the topic in the 7th (55.6%) and 10th (67.7%) grade but least in grade 12 (52.9%). The subsequent table displays all percentages and numbers of participants. Figure 12 shows the percentage distribution of the 4-point Likert Scale ranking split by school and grade:

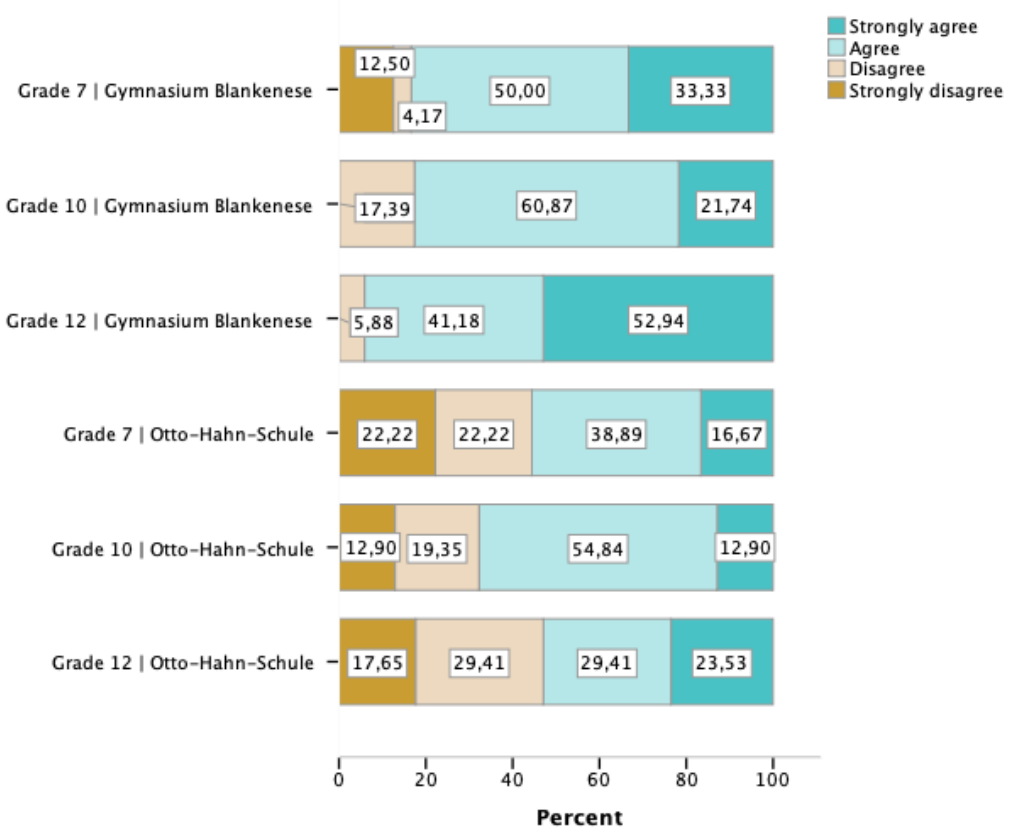

Figure 12: ‚It is important to me that food is produced sustainably' (n=130)

5.1.8 Change in perceived importance of sustainable food production

A marginal decrease was recognised concerning the sustainable food production in Blankenese's 7th grade from 83.3% to 78.3%. The agreement in 10th grade rose from 82.6% to 91.3% while the results in the twelfth class remained constant at 94.1%. These changes did not reflect a significant change in this school (Mdn=3), z=-0.92, p>0.05, r=-0.08 with no effect. The same applies to the 7th graders in Jenfeld where the values remained unchanged at 55.6%. In contrast, the values in the 10th grade rose from 67.7% to 74.2% and the biggest change was recorded in the 12th grade from 52.9% to 64.7%. Again, no significant changes occurred (Mdn=3), z=-1.05, p>0.05, r=-0.09 with no effect. All in all, no significant changes could be seen in the outcomes of the entire audience prior (Mdn=3.00) and after the intervention (Mdn=3.00) z=-0.92, p>0.05, r=-0.09. Figure 13 shows the percentage distribution of the 4-point Likert Scale ranking split by school and grade:

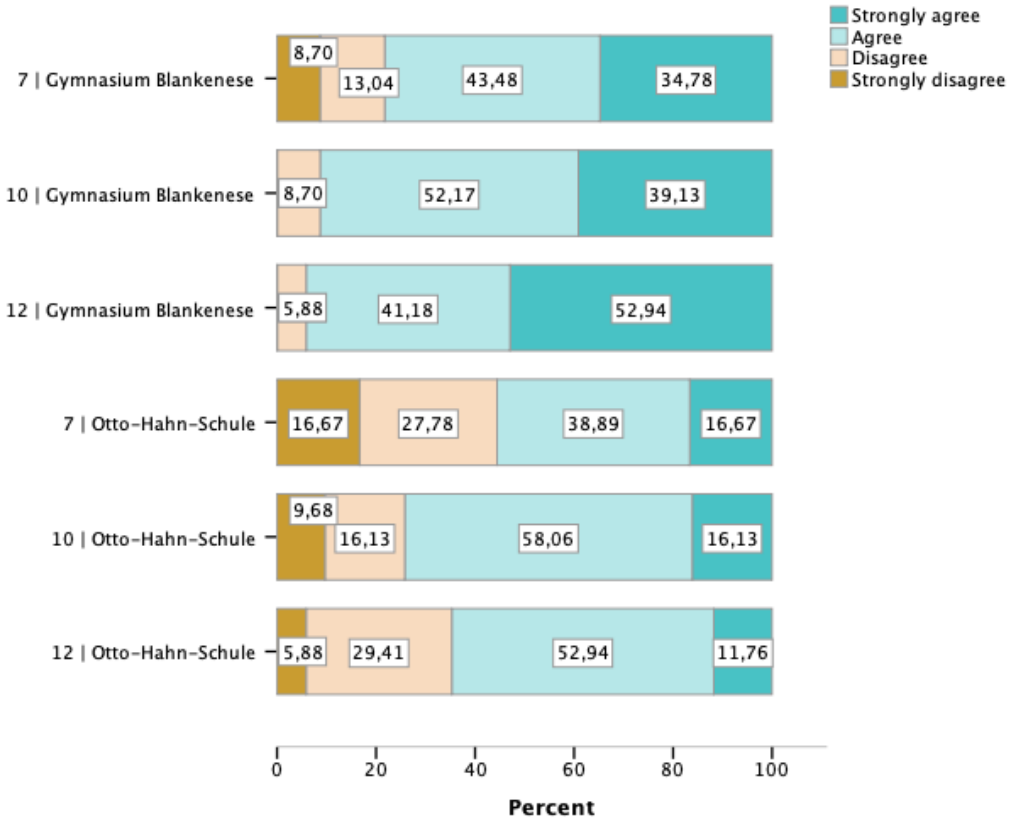

Figure 13: 'In the future, it is important to me that food is produced sustainably.' (n=129)

5.1.9 Perceived importance of sustainable clothing production

The majority (54.1%) of Blankenese's 7th did not perceived sustainably produced clothing as important at baseline. In contrast, the majority of the 10th (60.9%) and 12th (58.8%) grade considered it important to produce clothing sustainably.

On the whole, sustainably produced clothing is less critical for Jenfeld's students. Most 7th grade students (61.1%) did not find the topic important, while more than half of the 10th graders (58.1%) found that issue more relevant. In the 12th graders, this topic was the least relevant (64.7%). The following figure 14 shows the percentage distribution of the 4-point Likert Scale ranking split by school and grade:

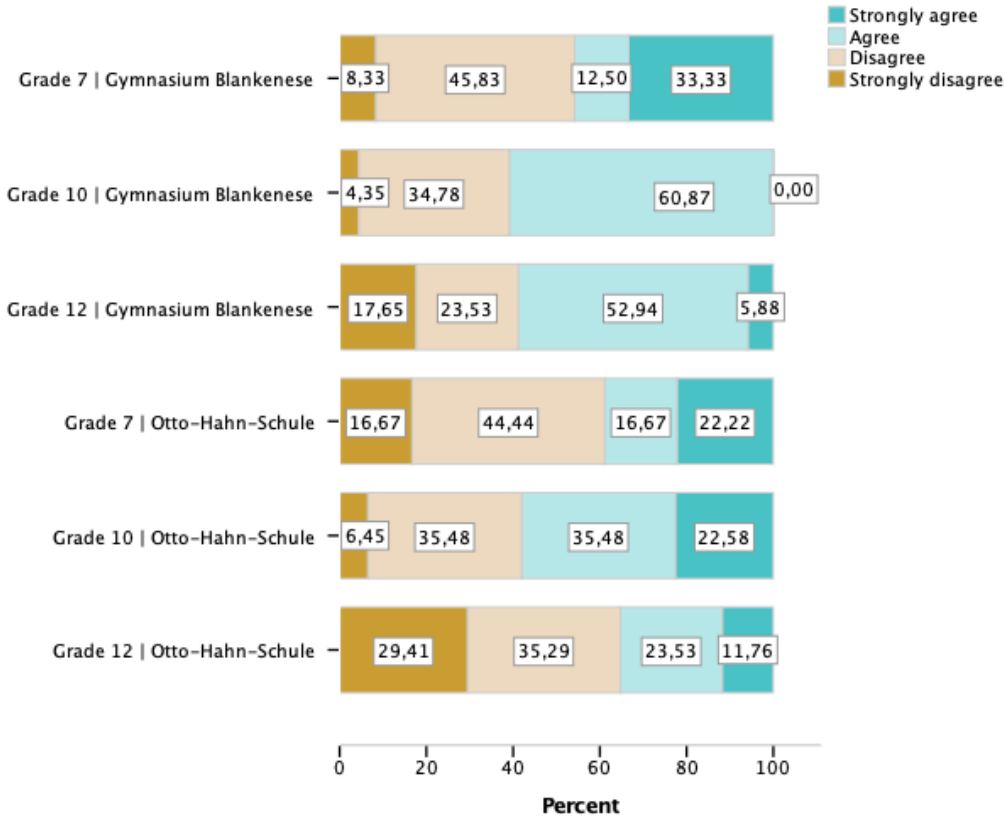

Figure 14: ‚It is important to me that clothing is produced sustainably.' (n=130)

5.1.10 Change in perceived importance of sustainable clothing production

In terms of attitude towards sustainable clothing production, all groups in Blankenese reported higher rates of agreement after the intervention compared to before. The perceived importance of sustainably produced clothing grew from 54.1% to 69.6% in grade 7 and from 60.9% to 69.6% in grade 10. The highest increase was seen in the 12th grade, from 58.8% to 80.6%. In the before (Mdn=3.00) and after (Mdn=3.00) comparison, the attitude towards the relevance of the topic has risen significantly with a medium effect z=-3.36, p<0.05, r=-0.3 in Blankenese.

Also, all groups in Jenfeld rated the perceived importance of sustainably produced clothing after the intervention higher than before (Mdn 3.00). While a moderate increase was observed in the 7th grade from 39.9 % to 50% and 10th grade from 58.1% to 64.6%, the values in the 12th grade almost doubled from 35.3% to 64.7%. Nevertheless, no significant effect could be observed (Mdn=3), z=-0.673, p>0.05, r=-0.6. However, the changes in attitude were still significant for the entire audience with a small effect (Mdn=3.00), z=-2.73, p<0.05, r=-0.17. Figure 15 shows the percentage distribution of the 4-point Likert Scale ranking split by school and grade:

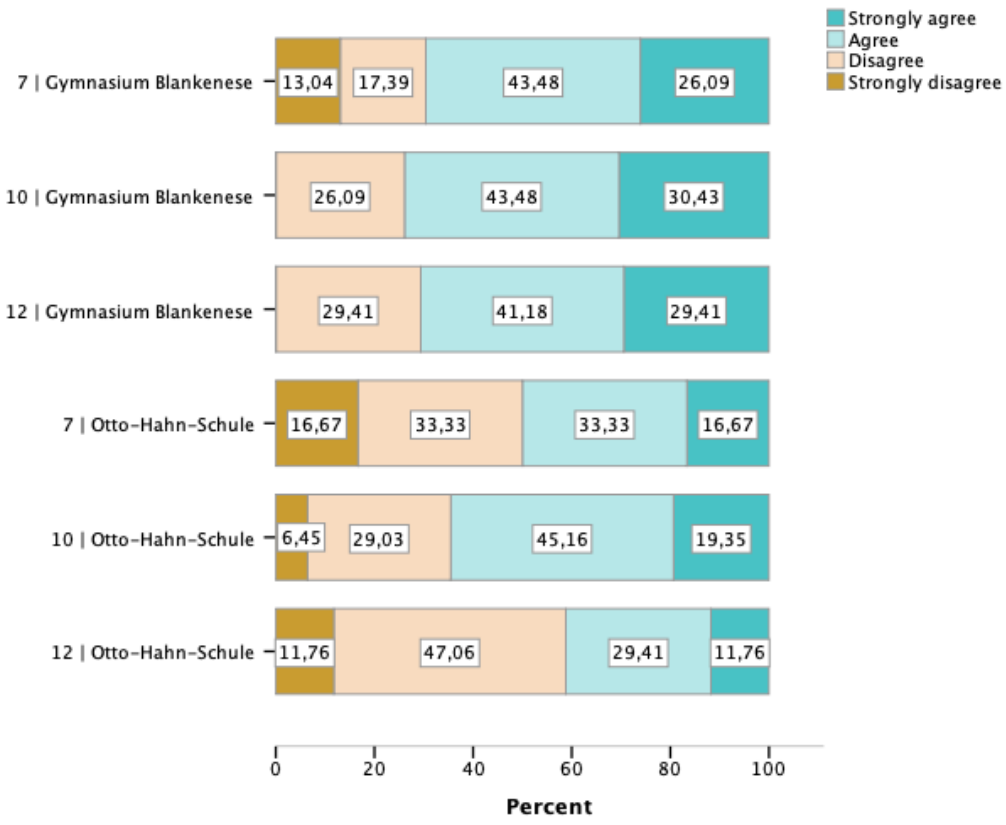

Figure 15: ‚In the future, it is important to me that clothing is produced sustainably.' (n=129)

5.2 Changes in knowledge assessment

On average, after using the prototype, the participants had a 1.17 95%CI(0.90, 1.45) ($t(129)=8.38$, $p<0.05$) higher score in the knowledge assessment as compared to before the intervention.

The analysis showed that the participants had on average 3.62 (SD 1.23) out of six correct answers in the knowledge assessment before and 4.78 (SD 1.61) out of six correct answers after the intervention. This difference of 1.17 (SD 1.6) correct answers, was significant ($p<0.05$) when tested by a paired sampled t-test.

5.2.1 Differences in knowledge assessment among the schools

Split into both schools, Gymnasium Blankenese had on average 4.16 (SD 1.34) correct answers before the intervention while Otto-Hahn-Schule had a mean of 3.1 correct answers (SD 1.68). With the follow-up after the intervention, both schools increased their score to a mean score of 5.14 (SD 0.92) at Gymnasium Blankenese and 4.44 (SD 1.38) at Otto-Hahn-Schule.

As a result Gymnasium Blankenese had on average 1 95%CI(0.66, 1.31) [$t(63=6.04$, $p=0.000)$] more correct answers after using the prototype while Otto-Hahn-Schule had 1.35 95%CI(0.9, 1.8) [$t(65=6.02$, $p=0.000)$] more correct answers.

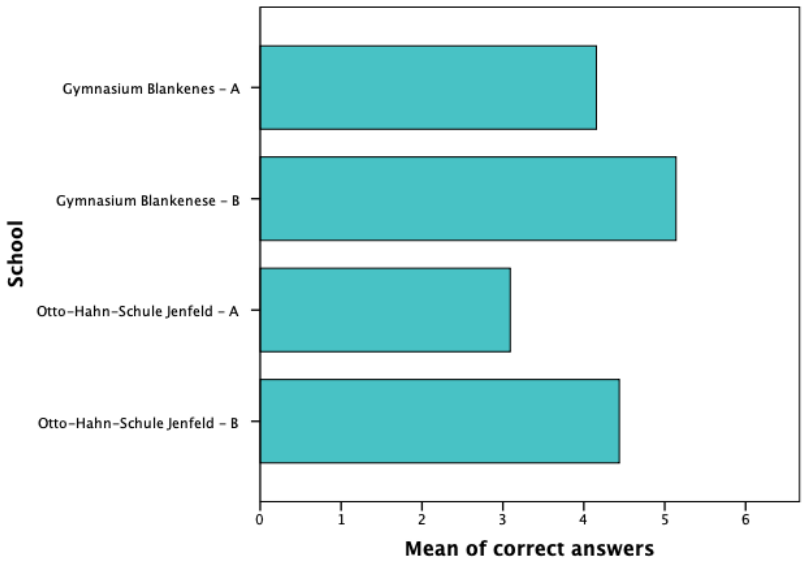

Figure 16: Mean score of correct answers in pre-post-comparison split by school

5.3 Association among gender and attitudes towards sustainability

In order to detect gender differences in attitudes towards the monitoring of daily water consumption, healthy nutrition, sustainable action and sustainable production of food and clothing, the responses of girls and boys were compared before the intervention.

The results of the chi-square tests showed no significant association between gender and the perceived importance of monitoring their daily water consumption, $x^2(3)=1.65$, $p=0.65$, $\phi=0.11$, healthy nutrition, $x^2(3)=1.59$, $p=0.662$, $\phi=1.11$, sustainable action, $x^2(3)=6.22$, $p=0.89$, $\phi=0.07$, sustainably produced food, $x^2(3)=7.56$, $p=0.07$, $\phi=0.24$ and the perceived importance of sustainably produced clothing, $x^2(3)=1.24$, $p=0.74$, $\phi= 0.1$. Hence, no significant differences among genders and the named items could be found in all five questions.

5.4 Opinion poll on interest in sustainability and sustainable behaviour

At the end of the intervention, the children were asked about their current interest in sustainability, the SDGs, the perceived effectiveness of the app and the interest in using it during their leisure time.

5.4.1 Interest in sustainability post-intervention

Regarding the interest in learning more about the field of sustainability in general, figure 17 demonstrate the revealed outcomes of the opinion poll. has revealed the following:

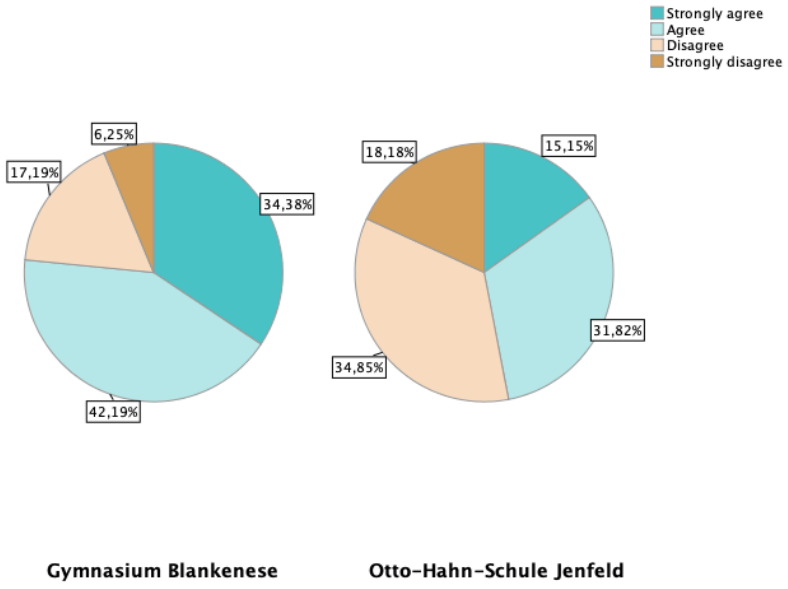

Figure 17: 'I am interested in learning more about sustainability.' in percent (n=130)

All in all, 61.5% of the students would like to learn more about sustainability. The results show that the interest in sustainability at Gymnasium Blankenese, with a total of 76.57%, was markedly higher than at district school Jenfeld by 46.97% where the majority was not interested in the subject even after the intervention.

5.4.2 Interest in learning more about Sustainable Development Goals post-intervention

The opinion poll with regard to the interest to learn more about the SDG's shows a similar picture:

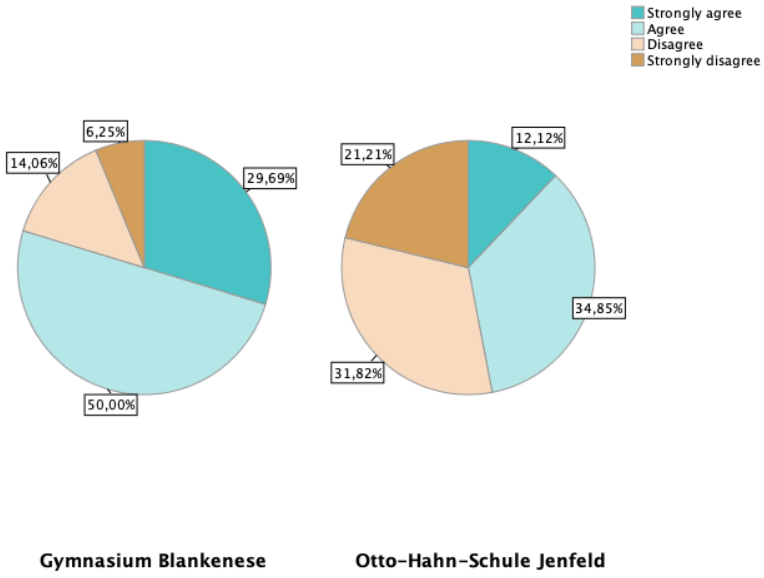

Figure 18: 'I am interested in learning more about the Sustainable Development Goals.' in percent (n=130)

In total, 63.1% of the students were keen to learn more about the SDGs. Again, in Blankenese, 79.69% of students want to learn more about this field while only 47.97% did in Jenfeld.

5.4.3 Perceived contribution of ‘Choiz!’ to promote sustainable behaviour

Similar values were also shown with concern to the opinion whether the use of the end product could contribute to more sustainable action.

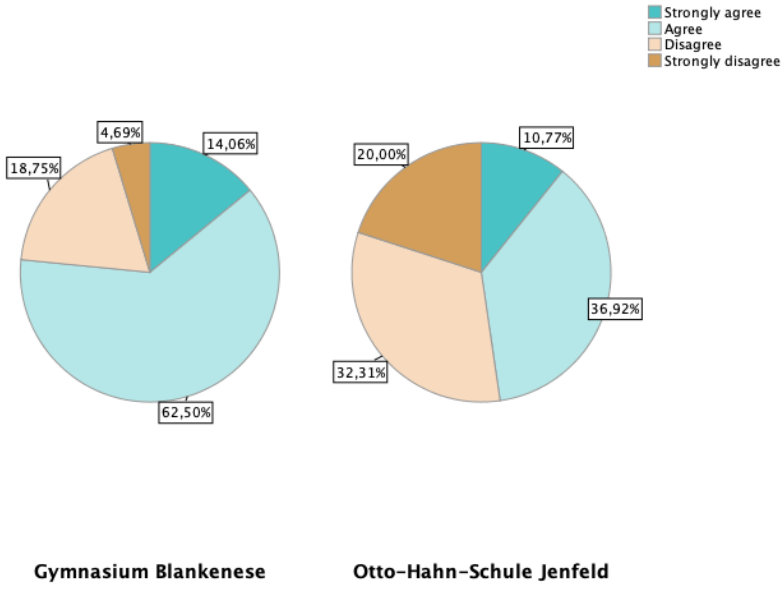

Figure 19: 'I could imagine that ‘Choiz!‘ could contribute to sustainable behaviour.’ in percent (n=129)

Altogether, 62% of students could imagine that Choiz! could contribute to increasing sustainable action. In Blankenese, a total of 76.56% reported so, whereas in Jenfeld, only 47.69% of the participants could envision this.

5.4.4 Motivation to use ‘Choiz!’ in student’s leisure time

As far as the motivation of students to use the app in their free time is concerned, the schools showed a more similar picture:

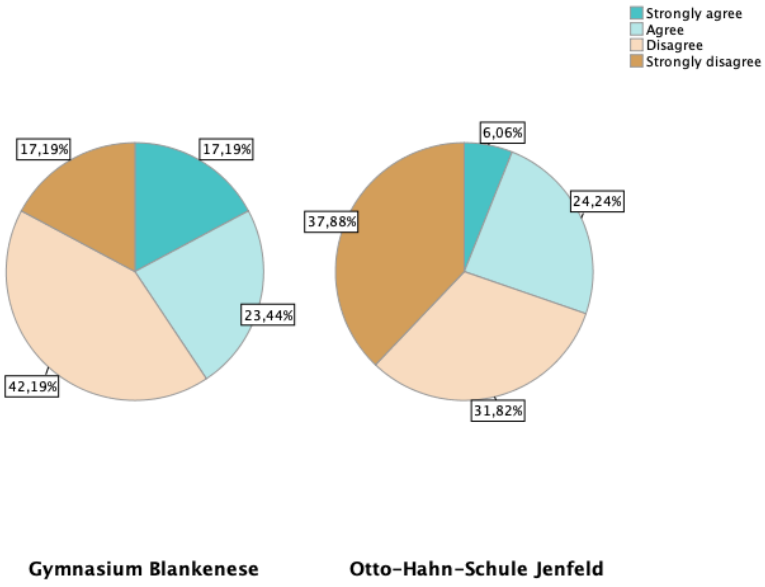

Figure 20: ‘I would also use the app in my leisure time.’ in percent (n=130)

Less than half (35.3%) of all students would use the app in their free time. However, 40.63% of Blankenese’s students, but only 30.3% in Jenfeld would use Choiz! in their free time.

The findings demonstrated above will be discussed in the next chapter.

6 Discussion

This thesis aimed to assess the association between a learning app that promotes sustainable action and the motivation to adopt more sustainable behaviour in Hamburg students and also whether there are disparities between different social indexes, age and gender. The investigation was conducted at a Gymnasium in Blankenese, a wealthier area of Hamburg and an inclusive district school with lower status of the citizens in Jenfeld. Some of the older participants in Blankenese have already gotten in touch with the SDGs, as they were still included in the curriculum.

6.1 Interpretation of the results

This chapter discusses the characteristics of the sample, attitudes towards sustainability by the school, age and gender, and relates them to the research questions, previous studies and data. In this chapter, similarities will be outlined, and unexpected results will be explained. Since the characteristics of the sample are necessary to put the results into perspective, they will be displayed first, followed by attitudes towards sustainability at the baseline compared to the results immediately after the intervention while taking gender into account, as well as changes in knowledge assessment and general interest in sustainability and the SDGs after the intervention.

On the grounds of the Social Monitoring Report 2019 (Freie und Hansestadt Hamburg, 2019) and the Social Index for schools (Bürgerschaft der Freien und Hansestadt Hamburg, 2018), it is assumed in this thesis that the main part of the students of Gymnasium Blankenese have a high SES background, while the majority of the students of the district school Otto-Hahn-Schule in Jenfeld have a background related to a low to very low SES. Hence, a high respectively low SES is attributed to the schools as such and compare them with each other.

Based on this assumption and the German Environmental Awareness Study of BMU & UBA (2018) described in chapter 2.6, it can be assumed that the number of so-called Young Idealists at Gymnasium Blankenese could be higher than at Otto-Hahn-Schule and that accordingly the number of Young Distanced would be found predominantly at Otto-Hahn-Schule.

With this in mind, it would indicate that the values of the students in Blankenese would show a higher interest in environmental issues and sustainability than the students in Jenfeld according to the BMU & UBA study (2018) as well as to the Shell Youth Study (Deutsche Shell Holding Gm, 2019).
In the discussion below, it is examined whether these findings are applicable to the schools examined in this thesis. Furthermore, it is discussed whether SES played a role regarding attitudes and knowledge towards sustainability and whether age and SES were associated with changes in attitudes towards sustainability after using the prototype.

6.1.1 Perceived importance of monitoring daily water consumption

Regarding the awareness of the daily water consumption, the majority of both schools were not aware of this topic at baseline. Notably, a clear connection between social status and awareness can be seen in the 7th graders as only 16.7% saw the relevance in economical use of water in Jenfeld, but 45.9% in Blankenese. In the 10th grade, the differences in outcomes were not so marked, whereas in Blankenese's 12th grade about 12% more students considered the topic important than their colleagues in Jenfeld.

According to a UBA study 'Environmental awareness and environmental behaviour of young people' (2016), adolescents and young adults attach less importance to an intact environment and the opportunity to enjoy nature for a healthy life (21%) than older respondents (30%). This could be attributed to other life-stage priorities such as 'being safe in the family or community', 'achieving a high standard of living' or 'school development and the associated self-development and self-determination'.
The fact that Hamburg is surrounded by canals and rivers and gives the impression that there is no shortage of water could be another reason why pupils find it less important to observe their water consumption. There appears to be an association between age and the perceived importance of monitoring the daily water consumption in Jenfeld. All in all, the students in Blankenese seem to perceive a higher importance related the issue.

Contrasting the perceived importance of monitoring the daily water consumption prior to the intervention, the rate of both groups increased significantly after using the prototype. The highest increase in perceived importance was seen in Blankenese's 10th grade while the 12th graders already had the highest level of consciousness before the test and also showed the most considerable degree of consciousness after the test since nearly all of them want to be aware in this field in the future. In higher grades, monitoring the daily water consumption was rated as important more frequently than in lower grades.

These findings are in line with a recent study from Ispos 'Older people live more environmentally aware than young people – but environmental behaviour changes most among the young' (2019). It revealed similar outcomes in terms of environmental awareness but also suggested that the behaviour of the younger generation would change the most since the growth of environmental awareness was most substantial in no other age group than among the younger people surveyed.

Altogether, there seems to be a connection linking age and awareness, with the greatest difference being among the 7th and 10th grade. In the 10th and 12th grade, no difference was worth mentioning. Even if all classes in Jenfeld indicated a significant change of opinion, the change in perceived importance was higher in Blankenese.
As a result, it seems to be more relevant for the students with higher SES and growing age to monitor water consumption.

6.1.2 Perceived importance of healthy nutrition

Concerning the importance of healthy nutrition, much more participants agreed or strongly agreed on this topic compared with monitoring the daily water consumption. At baseline three-quarters of the 7th graders and even almost all (93.8%) of the 12th graders found a healthy diet important. In higher grades, healthy nutrition was an issue of importance more frequently than in lower grades.
For the majority of Jenfeld's 7th graders, a healthy diet was not relevant at first. However, more than half of the 10th and 12 graders ascribed relevance to the topic. The importance increased slightly with age, so a tendency could also be seen here.

The perceived importance of healthy diet seems to be more associated with higher SES. The German KiGGS study confirms these outcomes.

Since the KiGGS baseline survey (2003-2006), the researchers have identified disadvantages concerning healthy diet for children and adolescents with low SES compared to their peers from socioeconomically better-off families in both follow-up surveys in 2009-2012 and 2014-2017. With the growing age of the respondents, the percentage of girls and boys who ate fresh fruit every day fell. For both sexes, the fresh fruit intake of children and adolescents rose as SES increased. While overall only 47.2% of children and adolescents between 3-17 years with low SES ate fresh fruit every day, peers with high SES ate more (65.4%).

Kuntz, Waldhauer, Zeiher, Finger & Lampert (2018) explained the differences in nutritional behaviour between the different SES by pointing out that families with lower SES would not benefit from health measures to the same extent.

Furthermore, with growing age, the proportion of daily fresh fruit consumption would decrease, which is not apparent in the present study, at least regarding to attitudes towards a healthier diet, as healthy eating became more critical in the representatives with growing age (Kuntz et al. 2018).

Other results from the KiGGS-study by Mensink et al. (2018) confirmed a higher proportion of children with lower SES, consume sugar-containing refreshment drinks daily. Concerning gender, around one-fifth of 3 to 17-year-olds in Germany consume sugar-containing soft drinks every day - boys (22.2%) significantly more often than girls (16.9%).

However, when it comes to attitudes towards healthy eating, no gender correlation could be observed in the present investigation. Both schools demonstrated a significant increase in the perceived importance of this topic post-intervention. The highest increase was seen in Blankenese's 7th graders from 75% to 87.5%, and surprisingly a drop of 4.3% (from 82.6% to 78.3%) in the 10th grade. In the 12th grade, the already high level of perceived importance remained the same. A trend among age and perceived importance could not be confirmed by the analysis, possibly because the demands on healthy eating were quite high from the start for all grades.

The greatest change in Jenfeld was observed in the 10th grade (from 56.7% to 74.2%), the class with the strongest acceptance of the topic post-intervention. Less than three-quarters of the participants in the remaining classes attributed relevance to the topic. Consequently, the link concerning age weakens, but the association concerning SES and healthy diet in favour of the high-status group in Germany remains.

6.1.3 Perceived importance of sustainable action

For the majority of Blankenese's students, it is important to act sustainably at baseline. With increasing age, a tendency in the perceived importance of acting sustainably could be observed from 62.5% of the 7th graders to 82.3% of the 12th graders.

In Jenfeld, the students attached less importance to the topic. The topic was only important for 44.4% of 7th graders. For the majority of the tenth (56.7%) and twelve-graders (66.6%) sustainable action is a topic of importance. The perceived importance of sustainable action also increased in the district school with growing age. Again, there appears to be a link between SES and the perceived importance of sustainability.

These results are supported by the BMU & UBA study (2018), which showed that Young Idealists, i.e. young people with higher SES, have a higher level of environmental awareness than the Young Pragmatics and the Young Distanced.

Significant changes in perceived importance of sustainable action could be found in Blankenese since the agreement grew from 83.4% in the 7th grade to even 94.1% in the 12th grade. Again, there seemed to be an emerging trend in this school with growing age regarding the importance of sustainable action. By contrast, no significant changes appeared in Jenfeld. Even though the results of the 7th graders rose to 50%, the results of the 10th graders fell to 48.4%. In the 12th grade again, there was an improvement to 70.6%. These outcomes, especially the drop of the 10th grade, may have influenced the overall score. It is not entirely clear how the drop occurred, it can be assumed that due to the inclusive class situation, some students on one side may have forgotten what they had ticked before and on the other side were overwhelmed with the amount of information. Nevertheless, the overall outcomes were significant, with a trend among SES and increasing age in terms of sustainable action.

These outcomes go hand in hand with the results of the study (BMU & UBA, 2018) where the environmental behaviour of the Young Distanced in everyday life was clearly below average. In energy, agricultural and transport policy, they were less concerned with the environment and climate than with cost considerations and socially acceptable design. The same applied to the Young Pragmatics, who opined that environmental and climate protection should be restricted in order to achieve other goals, or at least compromises would be necessary.

6.1.4 Perceived importance of sustainable food production

For a large number of students in Blankenese, sustainably produced food has been an important issue before the intervention. While there was no significant difference between the 7th and 10th grade (83.3% / 82.6%), almost everyone saw the necessity in the 12th grade (94.1%). A link between age and attitudes towards sustainably produced food could be suggested.

These outcomes are in line with the results of the BUA Study in which the Young Idealists were more convinced that environmental protection and nature conservation are among the most essential tasks of agriculture. Young Pragmatics and Young Distanced people, on the other hand, reported these tasks less often.

In Jenfeld, at least more than half of the students also saw the relevance of this topic, but no conclusions can be drawn about age trends, as the topic was slightly less relevant for the 12th grade (52.9%) than for the 7th grade (55.6%), whereas the 10th grade had the highest figure with (67.7%). The majority of both schools recognised the relevance of this issue, with the more affluent participants attributing importance to the topic more often.

These differences can also be linked to the structure of the primary supply of organic food. While there are six organic supermarkets in Blankenese, there are none in Jenfeld (Bonial International Group, state April 2020), although the population density in Jenfeld is about twice as high (Statistisches Amt für Hamburg und Schleswig-Holstein, 2018 a & b).

Even if discounters are now offering organic food at affordable prices, the non-existence of organic supermarkets can be considered as an indication of reduced financial resources and thus low demand.

This is in line with the outcomes of the EsKiMo II study by the Robert Koch Institute: 'Consumption of organic food by children in Germany' (2020) in 6-17-year olds, which has only published the findings of organic food consumption by children aged 6-11 years to date. The study found that children from families with low SES are the most frequent non-consumers of organic products. The proportion of children with an organic portion of over 8.0% increased as the SES of the family increased (Haftenberger, Lehmann, Lage Barbosa, Brettschneider, & Mensink, 2020).
Even though the representatives of this study are slightly older, they still depend to a large extent on their parents' food choices. Therefore, similar observations could also apply to 12-17-year olds.

Concerning pre-post comparison, no significant differences could be identified, which can also be attributed to the already frequent importance ratings at baseline. In the 7th grade of the Gymnasium Blankenese, a drop to 78.3% occurred, while in the 10th grade improvement was recorded. The 12th graders did not change their views and remained at high level.
This was also the case with the 7th graders in Jenfeld, who had not changed their opinion, while the other grades have awarded higher agreements, with the 10th grade assigning importance to this topic most often (74.2%).

To sum it up, no conclusion could be drawn regarding the age of the representatives with the results. However, the importance ratings seemed to be associated with the SES background of the students. The high perceived importance of the topic for the participants in Blankenese could be related to the income of their parents who can more easily afford to buy sustainable food.

6.1.5 perceived importance of sustainable clothing production

Most of the students in Blankenese found sustainably produced clothing important, although it was not relevant for the majority of the 7th graders (45.9%). The two higher grades had similar ratings on this issue (60.9% and 58.8%).

The production of sustainable clothing is only important for the greater part of the 10th graders (58.1%) in Jenfeld at baseline. Not even half of the 7th and 12th grades ascribed any importance to the topic. Hence, differences in perceived importance in the social strata also became visible on this topic.

The fact that sustainably produced clothing does not seem to be as important to the participants as, for example, sustainably produced food can be confirmed by the results of the UBA study (2016). Even if young people are worried about the environment and climate protection, they are also worried about their prosperity in terms of their future life planning. The consumption of (brand-name) clothing is an essential source of participation, and social recognition for many of them would hold value. In areas such as clothing or entertainment technology, it is hardly conceivable to dispense with them, although the reduction of textile consumption was also mentioned as an environmentally friendly option (UBA, 2016).

The findings of the German Greenpeace study ‘Usage & Attitude Fashion among young people – Results Report (2015) has shown that the appearance of clothing is the most important selection criterion for young people, followed by price. The country of manufacture and certifications such as "organic" or "fair trade" is less important, as these clothes would be too expensive for young people to afford. For the more affluent students, sustainable clothing production seems to be more important, probably because they have more financial resources at their disposal.

After using the prototype, significant changes in attitudes were found in Blankenese. Whereas in the 7th and 10th grades 69.6% of the students agreed to the importance, the 12th grade showed the highest increase reaching 80.6%. With growing age, the students seem to pay more attention to the topic in this school.

No significant changes could be observed in Jenfeld even when the proportion of those assigning importance to sustainably produced clothes rose to the half of 7th graders and around 65% in the remaining grades. Also, in Jenfeld, associations regarding age and attitude can be seen, although not rising steadily.

As with the other issues mentioned above, students with higher SES attached more importance to this sustainability issue, possibly due to the more affluent households that were more able to afford sustainable fashion, and to the different priorities of Young Pragmatics or Young Distanced described above.

6.1.6 Associations among gender and sustainability

When it comes to the association between gender and sustainability no significant associations were observed in the sample regarding the importance of water consumption monitoring, healthy diet, sustainable action, sustainably produced food and the produced clothing.

Concerning a healthy diet, these findings could not be confirmed by the RKI study by Kuntz et al. (2018), as it turned out that among 3-17-year olds, girls eat fresh fruit on a daily basis more often (59.5%) than boys (52.2%). Similarly, young women tended to be more interested in value orientations concerning a more conscious lifestyle.

Almost four out of five female adolescents compared to slightly more than two out of three male adolescents consider it necessary to be environmentally aware under all circumstances (BMU & UBA, 2018). Among the Young Idealists, there are significantly more young women than young men. In general, female respondents tended to show higher mean values for environmental effects and were more likely to agree with cognitive statements than male respondents in the study. They also achieved higher rates for self-reported environmental protection behaviour (BMU & UBA, 2018).

A similar situation can be observed on the Fridays for Future protests. According to Sommer, et al., (2019), the protests are supported by well-educated young people but actively by young women. During the first global climate strike on March 15, 2019, the proportion of young women had reached 64.6% among the students.

At both schools, which differed in their level of perceived importance of sustainability, no gender differences could be seen. However, the small sample size and limited representativeness of the sample limit the transferability of the results.

6.1.7 Knowledge gain post-intervention

To be able to change one's behaviour towards sustainable development, knowledge of these issues is a prerequisite (UNESCO, 2014; KMK, BMZ & Engagement Global, 2016; Wiek et al., 2011). The evaluation of the knowledge assessment in the pre-post comparison yielded significant improvements in both schools. While the students in Blankenese had, on average, 1.0 more correct answer after the intervention compared to before, students in Jenfeld gained 1.35 correct answers. However, the participants at the Gymnasium were about one score better than their peers in the district school at baseline and achieved a superior score with more than 5 out of 6 correct answers whereas Jenfeld achieved more than 4 out of 6 correct answers. The significant increase in knowledge could indicate that Choiz! may be a suitable tool to encourage sustainable behaviour of the target group. Possibly the participants in Blankenese had already had a little more previous knowledge in order to achieve a higher score right from the start.

Compared to the students in Blankenese, the score of the students in Jenfeld was still a little lower after the intervention, which could be related to the diversity of the inclusive district school. Presumably, not all participants were able to absorb the new information in such a short time, to internalise it and to apply it in the questionnaire.

6.1.8 Interest in sustainability and sustainable behaviour post-intervention

The opinion poll after the intervention should provide information on whether Choiz! can stimulate the interest of the users and thus motivate them to act sustainably. Simultaneously, it should also indicate whether the target group feels addressed or whether further measures are necessary.

In general, it can be said that more than three-quarters of the students in Blankenese showed great interest in sustainability and the SDGs, while less than half of the students in Jenfeld were interested in these topics.

This observation is comparable to the results of the BMU & UBA study (2018) in which the more privileged teenagers demonstrated a higher level of environmental awareness than the ones with lower SES.

A similar distribution applied to the question concerning whether Choiz! would motivate sustainable action. Findings of the BMU and UBA study (2018) showed that participants who were more interested in sustainability, knew more about it and seemed to behave more sustainably and were more likely to believe that the learning tool could motivate users to act more environmentally conscious than those who were less interested in the topic, knew less about it and seemed to act less environmentally consciously.
The findings of the BMU & UBA study (2018) can also be transferred here. The students in Blankenese with the supposedly higher number of Young Idealists seemed to be more easily motivated for environmentally conscious behaviour or was more motivated from the beginning, which lead them to believe that others could also be motivated by this app. In contrast to this, the group in Jenfeld was rather difficult to motivate with the assumed higher number of Young Distanced and therefore they were also less likely to imagine that others would benefit from it.

When it comes to using the app in leisure time, less than half of the students in both groups were motivated, even though slightly more students in Blankenese would use the app in their leisure time. The low motivation to use learning material in leisure time compared to the interest in the topic should not be surprising. That at least 35.3% would still use the app in their spare time could be seen as a successful realisation of the app, after all, it is learning material.

It also became clear from the guided discussions held and the open questions in the questionnaire that Jenfeld's students had the impression that the issues of sustainability did not concern them. Statements like: 'For people who are interested, the app might be useful, but the topic doesn't concern me.' were mentioned frequently and are showing that not all students felt addressed. This attitude also indicates that further measures to ensure that no one is left behind are urgently required to reach the goals.

The similar attitude was also reflected in the answers to the open questions, which mainly concerned the optimization of the app. While there was little constructive criticism and the questions often remained unanswered by the students of the district school, most of the high school students were more cooperative and realized that this app could be an opportunity for them and that especially the learning material could benefit from it if they supported the optimisation process.

6.2 Summary

This study could show that the prototype could have a positive influence on pupils' attitude towards sustainability, at least in the short term. Although this investigation is only a snapshot due to its short duration and it is not clear how long this positive change will last, a tendency that even such small measures could lead to success was shown. The outcomes can be interpreted as an indication that the final product of the app, which is suitable for long-term use between grades 7 and 13, might be a suitable measure for achieving sustainable changes in the areas of knowledge transfer, attitudes towards sustainability issues and sustainable action.

Furthermore, the findings illustrate that the interest in sustainability might be related to the social status, which is often also related to the available financial and educational resources.

These differences also point to inequality of opportunity. To end this, the SDG Roadmap (UNESCO, 2014) proposes to allow young people to use the enormous benefits of information and communication technologies, including social media, not only for learning but also for networking. E-learning on ESD and online platforms where young people can share their ideas and actions on sustainable consumption and lifestyles are mentioned as promising approaches. The mass mobilisation of the youth for sustainable development requires that young people be provided with information about the impact of their daily decisions and actions, while at the same time tapping into their creativity and determination to find practical and innovative solutions and alternatives (UNESCO, 2014).

The app Choiz! meets all these requirements. Based on the positive results and feedback from the students, it can be assumed that if Choiz! is used regularly it will obtain an essential and lasting contribution to promote students in the 7th to 13th grades in Hamburg to behave more sustainably. Since it has been shown that younger students have often shared less agreement than older students in the items tested, it is worth focusing on education for sustainable development in younger grades.

6.3 Limitations

The results of this thesis are linked to a list of limitations, which will be outlined in the following. First, the limitations of the study design are discussed, followed by the data analyses.

A major limitation of this study is the lack of a control group and a lack of randomisation which can lead to confounding factors, as differences between the experimental groups cannot be clearly attributed to the intervention (Sedlmeier & Renkewitz, 2008).
As a statistic association does not necessarily implicate causality, other alternative explanations or independent variables (Harris et al., 2006) such as education, concentration and cognitive skills, language and comprehension difficulties due to a migrant background or the inclusive concept of the district school as well as the class atmosphere may become confounding variables and thus influenced the accuracy of the results.
If someone is unable to follow the content of the intervention correctly or needs more time to understand the questionnaire was provided, the results may not be due to a change in attitude or an increase in knowledge, but due to intuitive decisions or guesswork. For reliable and valid results, a randomised controlled trial would be the choice to determine efficacy but would go beyond the scope of resources. However, due to the fixed allocation of the participants, it was not possible to control for any cofounding variables.

Furthermore, the sample of this investigation could not fulfil the required estimated population parameters of 383 Participants calculated with a confidence interval of 95%, a type I error of 5% and population proportion of 50%.

Hence, the results cannot be generalised to the population as this sample was not able to represent the target population and therefore, this investigation may not be able to detect the difference between test groups and pre-post-test timepoints. In addition, group sizes varied, which may influence outcomes in terms of significance. Moreover, even though the school classes were purposefully selected to increase variability, the sample was not representative of the German youth.

The duration of the intervention is another weakness. Due to the lack of resources regarding curricula and personal of the state institute, as well as the school holidays, no second follow-up survey could be carried out. Therefore, the long-term effects of this investigation cannot be quantified.

Even if the design of the intervention is clearly defined in terms of time, procedure and content, there may still be adjustments to accommodate attendees. The intervention requires the cooperation of the participants, which barely allows for an exact same procedure. Likewise, high demands are placed on the objectivity of the investigators in order not to influence the participants in their view so that the most objective results about the influence of the app on the attitude towards sustainability are obtained.

Regarding the methods, the questionnaire was self-developed and to date not standardised or validated, and the reliability was not assessed. It should also be mentioned that the knowledge assessment could only provide a small insight into the knowledge of the participants on the topic of sustainability and could not claim to make comprehensive statements about the actual knowledge of the students on the topic.

Last but not least, the response behaviour of the participants may be influenced simply by knowing that it is an examination. Therefore, the transfer of the results into the everyday situation of the students is questionable.

6.4 Future research

Naturally, from this thesis, further research ideas arise to understand the influence of learning materials in the sense of ESD on the behaviour of students. This thesis was one of the first steps to investigate the influence of digital learning material with regard to ESD in Germany. A positive influence of the prototype on the participants' attitude and perhaps also on the behaviour could be observed. What could not be investigated are the long-term effects and competencies that regular use could entail.

Multidisciplinary approaches with both quantitative and qualitative components can yield informative results about the influence of this learning material on the students and thereby provide new application instructions and recommendations for Germany. Since this thesis could only investigate the short-term effect of the prototype, further investigation with the final product of Choiz! is highly recommended. The inexpensive and simple test setup using questionnaires could be maintained, but some extensions should be made.

As the final product will contain more content, more time for using the app, four weeks as an example, should be planned between the measuring points. It makes sense to limit the content to specific topics to avoid overwhelming information. To highlight attained competencies, changes in attitudes and behaviour, it makes sense to limit the investigated content to specific topics such as health (e.g. SDG 1 - No poverty, SDG 2 - zero hunger, SDG 3 - Good Health and Well-being) and climate change (e.g. SDG 7 - Affordable and Clean Energy, 13 - Climate Action, SDG 14 - Life below Water, SDG 15 - Life on Land). Long-term successes could be identified in the follow-up after three months and further after six months.

In addition to asking about one's attitudes and knowledge about the sustainability issues concerned, the included action map of Choiz!, explained in chapter 4.2, is a suitable tool for establishing associations between the use of the app and the actual results over the entire period. If significant social disparities continue to emerge, more adapted measures must be taken by the government and responsible authorities to ensure that all can contribute to achieving the SDGs by 2030.

7 Conclusion

This thesis pursued three objectives. These were to determine the attitude towards sustainable action in everyday life of students living in Hamburg, to analyse whether the use of the app Choiz! is able to promote students motivation to adopt more sustainable behaviour in everyday life and to identify whether there are disparities between the students with different Social Index and gender in terms of attitudes and behaviour as well as level of knowledge towards sustainability.

As the literature sights, the growth of environmental awareness is in no other age group more pronounced than among young people, which is fundamental for a change in behaviour. This encouraging attitude is also reflected in the present investigation and is, therefore, a valuable building block for achieving the SDGs.

Despite its many limitations, including the limited representativeness of the sample and the resulting limited generalisability of the results, this thesis provided valuable insights into the extent to which young people are willing to participate in solving global challenges if they are sufficiently informed about them.

In both schools, significant changes in the perceived importance of monitoring the daily water consumption and healthy nutrition are to be highlighted. Significant changes with regard to the perceived importance for sustainable action and sustainably produced clothing only occurred in Gymnasium Blankenese. Also, both schools yielded significant improvements concerning knowledge gain.

Thus, the digital learning tool Choiz! might be able to motivate students to integrate sustainability into their everyday life. The complementarity between ESD and digital literacy, as recommended in the national action plan, is therefore, possible and expedient (BMBF, 2017).

In contrast to the findings of the literature, this examination could not identify a link among attitudes towards sustainability and gender (BMU & UBA 2018; Deutsche Shell Holding GmbH, 2019).

However, all positive changes and outcomes in every topic tested were more in favour of higher SES. Although these initial results would need to be repeated and confirmed in other studies, the disparities observed among high and low SES points to a critical issue.

In order to guarantee equal opportunities in the sense of the SDGs, it must be ensured that ESD can reach all and is accessible to everyone. Further research is needed on how the issue can more effectively address young people with lower SES and trigger a need for action in them.

Naturally, implementation is the responsibility of schools and teachers, but Choiz! can be a bridge and support for teachers to provide all students, even when they are not able to attend school, with essential, concise and well-prepared content on global challenges. Since it has been shown that younger students have often shared less agreement than older students in the items tested, it is recommended to already implement ESD in younger grades. Access to suitable and functional media for all is a necessary condition and must be ensured urgently so that no one is left behind.

In the sense of the SDG 17 – Partnerships for the goals, schools are encouraged to form more partnerships in the future, to create joint projects within the framework of ESD, to promote and mutually support each other and to prepare the young generation for the global challenges, so that the world remains worth living in for future generations.

'We are the first generation that can put an end to poverty and we are the last generation that can put an end to climate change, (…).'

Ban Ki-Moon (former UN Secretary-General, 2007 -2016)

(UN, 2015b)

8 References

ATD Fourth World (2015). Challenge 2015: Towards sustainable development that leaves no one behind. Paris: Editions Quart Monde.

Azeiteiro, U. M., Leal Filho, W. & Caeiro, S. (2014). E-learning and Education for Sustainability. Environmental Education, Communication and Sustainability. Frankfurt a. M.: Peter Lang.

Baecker, D. (2017). Wie verändert die Digitalisierung unser Denken und unseren Umgang mit der Welt? In: Handel 4.0, p. 3–24. Berlin Heidelberg: Springer Gabler.

Barth, M., Godemann. J., Rieckmann, M. & Stoltenberg, U. (2007). Developing Key Competencies for Sustainable Development in Higher Education. In: International Journal of Sustainability in Higher Education. 8(4), p. 416-430.

BITKOM (2019). Kinder und Jugendliche in der digitalen Welt. Retrieved from https://www.bitkom.org/sites/default/files/2019-05/bitkom_pk-charts_kinder_und_ jugendliche_2019.pdf. Accessed 13 Apr 2020.

BMBF (2017). Nationaler Aktionsplan Bildung für nachhaltige Entwicklung – der deutsche Beitrag zum UNESCO-Weltaktionsprogramm. Retrieved from https://www.bmbf.de/files/Nationaler_Aktionsplan_Bildung_f%C3%BCr_nachhaltige_Entwicklung.pdf. Accessed 16 Dec 2019.

BMBF (2018). Orientierung gefragt–BNE in einer digitalen Weltdiskussionspapier zur wechselseitigen Ergänzung von Bildung für Nachhaltige Entwicklung und Digitaler Bildung im Bereich Schule. Retrieved from https://www.globaleslernen.de/sites/default/files/files/link-elements/diskussionspapier_orientierung_gefragt_bne_in_einer_digitalen_welt.pdf. Accessed 16 Dec 2019.

BMU & UBA (2018). Umweltbewusstsein in Deutschland 2018 – Ergebnisse einer repräsentativen Bevölkerungsumfrage. 1st ed. Berlin: Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit.

Bonial International Group (state June 2020). kaufDa Hamburg. Retrieved from https://www.kaufda.de/Filialen/Hamburg/Jenfeld/Biomarkt-Biomaerkte/v-d8. & https://www.kaufda.de/Filialen/Hamburg/Blankenese/Biomarkt-Biomaerkte/v-d8. Accessed 20 Apr 2020.

BSB (2019). Schulen, Schülerinnen und Schüler des allgemeinbildenden Schulwesens im Schuljahr 2018/19. Retrieved from https://www.hamburg.de/contentblob/12149542/415732de510a261c192379b5453d075c/data/2018-19-schueler-schulform-jahrgangsstufe-anzahl-schueler.pdf. Accessed 25 Feb 2020.

Bürgerschaft der Freien und Hansestadt Hamburg (2018). Schriftliche Kleine Anfrage der Abgeordneten Sabine Boeddinghaus (DIE LINKE) vom 19.06.18 und Antwort des Senats: Der Sozialindex (KESS) an Hamburgs Schulen – Offene Punkte. Retrieved from https://www.hamburg.de/contentblob/12234860/7bfa075e9619a9be0f9b88f94fdfbcc6/data/pdf-hh-sozialindex-drucksache-21-13495.pdf. Accessed 17 Feb 2020

Cohen, J. (1992). A power primer. Psychological Bulletin, 112(1), p. 155-159.

de Haan, G. (2010). The development of ESD-related competencies in supportive institutional frameworks. International Review of Education, 56(2).

Deutsche Shell Holding GmbH (2019). Jugend 2019. Hamburg: Kantar.

De Kraker, J., Córvers, R. Valkering, P, Hermans, M. & Rikers, J. (2013) Learning for sustainable regional development: towards learning networks 2.0? In: Journal of Cleaner 49, p. 114-122.

Erpenbeck, J., & von Rosenstiel, L. (2017). Handbuch Kompetenzmessung. Erkennen, verstehen und bewerten von Kompetenzen in der betrieblichen, pädagogischen und psychologischen Praxis. 3rd ed. Stuttgart: Schäffer-Poeschel.

EWIK (n. d.) Bildungsmaterialien. Retrieved from https://www.globaleslernen.de/de/fokusthemen/fokus-sustainable-development-goals-sdg/bildungsmaterialien?page=1. Accessed 6 Jun 2020.

Fadel, C., Bialik, M. & Trilling, B. (2017). Die vier Dimensionen der Bildung: Was Schülerinnen und Schüler im 21. Jahrhundert lernen müssen. Hamburg: ZLL21.

Franke, G. (2015). Facetten der Kompetenzentwicklung. (1st ed.). Bielefeld: Bertelsmann.

Freie und Hansestadt Hamburg (pub.) (2019). Sozialmonitoring Integrierte Stadtteilentwicklung – Bericht 2019. Hamburg: Freie und Hansestadt Hamburg.

Greenpeace (2015). Usage & Attitude Mode unter Jugendlichen – Ergebnisbericht. Hamburg: Nuggets – market research & consulting GmbH.

Google Maps for Firefox (2020): Urban area Hamburg (online). Retrieved from https://www.google.de/maps/@53.5768361,10.0230205,11.44z. Accessed 17 July 2020.

Haftenberger, M., Lehmann F., Lage Barbosa, C., Brettschneider A.-K. & Mensink, G.B.M. (2020). Verzehr von Bio-Lebensmitteln bei Kindern in Deutschland – Ergebnisse aus EsKiMo II. Journal of Health Monitoring · 2020 5(1). Berlin: Robert Koch-Institut.

Harris, A. D., Mc Gregor, J.C., Perencevich, E. N., Furuno, J. P., Zhu, J., Peterson, D. E. & Finkelstein, J. (2006). The Use and Interpretation of Quasi-Experimental Studies in Medical Informatics. J Am Med Inform Assoc. 13(1), p. 16-23.

Ispos (2019). Ältere leben umweltbewusster als die Jugend – Aber Umweltverhalten ändert sich bei den Jungen am stärksten. Retrieved from https://www.ipsos.com/sites/default/files/ct/news/documents/2019-08/ipsos-pi_nawi-d_umweltbewusstsein_genz.pdf. Accessed 5 May 2020.

ITU News (2017). 3 apps proving tech is powerful force for good. Retrieved from https://news.itu.int/apps-for-good/ . Accessed 13 Apr 2020.

Kerres, M. (2018). Mediendidaktik. Konzeption und Entwicklung mediengestützter Lernangebote. 5th ed. Berlin: de Gruyter Oldenbourg.

KMK (2016). Strategie der Kultusministerkonferenz – Bildung in der digitalen Welt. Retrieved from https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2017/Strategie_neu_2017_datum_1.pdf. Accessed 16 Dec 2019.

KMK, BMZ & Engagement Global (Hrsg.) (2016). Curriculum Framework Education for Sustainable Development. 2nd rev. ed. Bonn: Cornelsen.

Kuntz B, Waldhauer J, Zeiher J et al. (2018) Soziale Unterschiede im Gesundheitsverhalten von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse aus KiGGS Welle 2. Journal of Health Monitoring 3(2), p.45-63.

Leal Filho (2014). E-learning for sustainable development: the way ahead. In: Azeiteiro, U. M., Leal Filho, W. & Caeiro, S. (eds) (2014). E-learning and Education for Sustainability in the series Environmental Education, Communication and Sustainability. Frankfurt a. M.: Peter Lang. Frankfurt a. M., p. 275-277.

LI (2014). Leitbild des Landesinstituts. Retierved from https://li.hamburg.de/contentblob/2800258/cfeea2606026b0081d189697987d34a8/data/pdf-leitbild-des-landesinstituts-2016.pdf. Accessed on 22 Jan 2020.

LI (2020). Veranstaltungskatalog. Retrieved from https://tis.lihamburg.de/katalog/veranstaltung_detail/print.action?tspm=&tspi=51980_&vsid=899831A04664B9A3968AC34F6957C3FE_448859. Accessed on 10 Jun 2020.

Mensink G. B. M., Schienkiewitz A., Rabenberg M. et al. (2018) Konsum zuckerhaltiger Erfrischungsgetränke bei Kindern und Jugendlichen in Deutschland – Querschnittergebnisse aus KiGGS Welle 2 und Trends. Journal of Health Monitoring 3(1), p. 32-39.

Rieckmann, M. (2011). Schlüsselkompetenzen für eine nachhaltige Entwicklung der Weltgesellschaft. Ergebnisse einer europäisch-lateinamerikanischen Delphi-Studie. ln: GAlA 20(1), p. 48-56.

Rieckmann, M. (2012). Future-oriented higher education: Which key competencies should be fostered through university teaching and learning? Futures, 44(2), p. 127-135.

Sangrà A., Vlachopoulos D., Cabrera N. (2012). Building an inclusive definition of e-learning: an approach to the conceptual framework. Int Rev Res Open Distrib Learn 13, p. 145–159.

Schulte, K., Hartig, J. & Pietsch, M. (n.d.). Der Sozialindex für Hamburger Schulen. Retrieved from https://www.hamburg.de/contentblob/4458462/5f7d1b2af92c58e7328be298374bbb05/data/pdf-schulte-und-hartig.pdf. Accessed 17 Feb 2020.

Sommer, Moritz, Dieter Rucht, Sebastian Haunss und Sabrina Zajak. 2019. Fridays for Future. Profil, Entstehung und Perspektiven der Protestbewegung in Deutschland, ipb working paper series 2. Berlin: ipb.

Statistisches Amt für Hamburg und Schleswig-Holstein (2018a). Hamburger Stadtteil-Profile: Berichtsjahr 2018: Jenfeld. Retrieved from https://www.statistik-nord.de/fileadmin/maps/Stadtteil_Profile_2019/pdf/Jenfeld.pdf. Accessed 06 Feb 2020.

Statistisches Amt für Hamburg und Schleswig-Holstein (2018b). Hamburger Stadtteil-Profile: Berichtsjahr 2018: Blankenese. Retrieved from https://www.statistik-nord.de/fileadmin/maps/Stadtteil_Profile_2019/pdf/Blankenese.pdf. Accessed 06 Feb 2020.

UBA (2016). Umweltbewusstsein und Umweltverhalten junger Menschen – Junge Leute wollen das gute Leben und die ganze Nachhaltigkeit: sozial – ökologisch – global fair!. Retrieved from https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/umweltbewusstsein_und_umweltverhalten_junger_menschen.pdf. Accessed 5 May 2020.

UN (2015a). The Millennium Development Goals report 2015. New York: United Nations.

UN (2015b). ‘We Are the First Generation that Can End Poverty, the Last that Can End Climate Change’, Secretary-General Stresses at University Ceremony. Retrieved from https://www.un.org/press/en/2015/sgsm16800.doc.htm. Accessed on 20 Jun 2020.

UN (2019). The Sustainable Development Goals Report 2019. New York: United Nations.

UNESCO (1987). Report of the World Commision on Environment and Development – Our Common Future. Retrieved from https://netzwerk-n.org/wp-content/uploads/2017/04/0_Brundtland_Report-1987-Our_Common_Future.pdf. Accessed on 25 March 2020.

UNESCO (2014). Roadmap for implementing the Global Action Programme on Education for Sustainable Development. Paris: UNESCO.

UNESCO (2015a). Rethinking education: towards a global common good?. Paris: UNESCO.

UNESCO (2015b) Education for All 2000-2015: Achievements and challenges. Paris: UNESCO.

UNESCO (2017a). Education for Sustainable Development Goals – Learning Objectives. Paris: UNESCO.

UNESCO (2017b). Education for Sustainable Development: Partners in action. Paris: UNESCO.

Unicef, n. d. Unterrichtsmateriel: Nachhaltige Entwicklungsziele – Die größte Unterrichtsstunde der Welt. Retrieved from https://www.unicef.de/informieren/ueber-uns/unicef-international/neue-entwicklungsziele/unterrichtsmaterial-worlds-largest-lesson. Accessed 22 Jan 2020.

Sedlmeier, P. & Renkewitz, F. (2008) Forschungsmethoden und Statistik der Psychologie. München: Pearson Studium.

Sibbel, A. (2014). An experience in developing and implementing blended learning for sustainability. In: Azeiteiro, U. M., Leal Filho, W. & Caeiro, S. (eds) (2014). E-learning and Education for Sustainability in the series Environmental Education, Communication and Sustainability. Frankfurt a. M.: Peter Lang, p. 15-27.

Sridharan, B., Deng, H. & Corbitt, B. (2010) Critical success factors in e-learning ecosystems: a qualitative study. Journal of Systems and Information Technology 12(4), p. 263-288.

Wiek, A., Withycombe, L., Redman, C.L. (2011). Key competencies in sustainability: a reference framework for academic program development. Sustainability Science, 6(2).

Sommer M, Rucht, D., Haunss, S. & Zajak, S (2019) Fridays for Future – Profil, Entstehung und Perspektiven der Protestbewegung in Deutschland. ipb working paper series 2. Berlin: ipb.

Statutory Declaration

I hereby declare that I wrote this thesis without any assistance and used only the aids listed. Any material taken from other works, either as a quote or idea have been indicated under ‘References‘.

_____ _____

Place, Date Signature

9 Appendices

Appendix I

CHOIZ – Du hast es in der Hand

Liebe Schülerin / lieber Schüler,
Vielen Dank, dass du uns bei der Testung des Prototyps der Schüler-App „CHOIZ – Du hast es in der Hand“, unterstützt. Damit wir die App optimieren und ansprechend für Schülerinnen und Schüler gestalten können, brauchen wir DEINE Hilfe!
Die Befragung ist anonym (geheim). Dein Name darf **nicht** auf dem Fragebogen stehen. Keiner wird hinterher nachvollziehen können, welche Antworten von dir stammen.
Hier ist DEINE Meinung gefragt, also beantworte die Fragen für dich. Es kommt nicht darauf an wie viel du weißt. Bitte gib ehrliche Antworten.

Durchführung:

1. Vor der Testung des Prototyps beginnst du mit dem ersten Fragebogen – Teil A. Dafür hast du 10 Minuten Zeit.
2. Danach durchläufst du die App, dafür sind 45 Minuten vorgesehen.
3. Zum Abschluss wird dir der zweite Fragebogen – Teil B, ausgeteilt. Für die Bearbeitung hast du 15 Minuten Zeit.
4. Alle Fragebögen werden zum Schluss in einem Umschlag eingesammelt.

Bitte lies dir genau die Aufgabenstellung vor der Bearbeitung durch.
Ist noch etwas unklar, frage gerne nach!

Begriffserklärung:
Was ist Nachhaltige Entwicklung?
Eine nachhaltige Entwicklung, dient den Bedürfnissen der jetzigen Generation ohne die Lebenschancen künftiger Generationen zu gefährden, ihre Bedürfnisse zu befriedigen. Wenn wir den Bestand und Vorrat der Natur, wie z.B. Holz nutzen, müssen wir gewährleisten, dass wir nur so viel Holz nutzen, wie natürlich nachwachsen, sich regenerieren und künftig wieder bereitgestellt werden kann.

Nachhaltigkeit wird in drei Dimensionen beschrieben, die in einem engen Abhängigkeitsverhältnis zueinanderstehen.

<u>Soziales – Umwelt – Ökonomie</u>
Nur durch das gleichzeitige und gleichberechtigte Umsetzen von umweltbezogenen, wirtschaftlichen und sozialen Zielen kann Nachhaltigkeit erreicht werden.

_____ LOS GEHT’S! _____

Fragebogen Teil A

CHOIZ – Du hast es in der Hand

Alter: ____

Geschlecht: ☐ weiblich
☐ männlich

Inwiefern treffen folgende Aussagen auf dich zu. Bitte setze ein Kreuz pro Aussage.

1. **Ich stehe auf Abenteuer**

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

2. **Auf meinen täglichen Wasserverbrauch zu achten, ist mir wichtig.**

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

3. **Eine gesunde Ernährung im Alltag, ist mir wichtig.**

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

4. **Nachhaltiges Handeln im Alltag ist mir wichtig.**
(Die Begriffserklärung zu „Nachhaltigkeit“ findest du auf dem Deckblatt)

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

5. **Mir ist es wichtig, dass Lebendsmittel nachhaltig hergestellt werden.**

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

6. **Mir ist es wichtig, dass Kleidung nachhaltig hergestellt wird.**

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

Teste dein Wissen! Setze bei jeder Frage nur **EIN** Kreuz.

7. **Das meiste Wasser, welches wir täglich verbrauchen, ist virtuelles Wasser. Was ist damit gemeint?**

- Virtuelles Wasser „versteckt“ sich in Dingen, die wir täglich nutzen. Man braucht es, um z. B. Nahrungsmittel oder Kleidung herzustellen.
- Virtuelles Wasser wird benötigt, um unsere elektronischen Geräte in Betrieb zu halten: Computer, Fernseher, Telefon.
- Virtuelles Wasser meint das Wasser, das wir z. B. zum Blumengießen oder Autowaschen verwenden.

8. **Wie hoch ist unser virtueller Wasserverbrauch in Deutschland pro Person/Tag?**
- 3.900 Liter
- 230 Liter
- 3 Liter

9. **Um die für die Erzeugung unserer Produkte gebrauchte Wassermenge zu berechnen, greifen Experten auf drei Kategorien zurück: Welche Definition beschreibt ‚graues Wasser'?**
- Graues Wasser beschreibt das natürlich vorkommende Boden- und Regenwasser, das von den Pflanzen direkt aufgenommen wird oder verdunstet.
- Graues Wasser beschreibt die künstliche Bewässerung von landwirtschaftlichen Produkten. Dieses Produktionswasser wird dem Oberflächenwasser oder Grundwasser des Gebietes entnommen und anschließend nicht mehr in ein Gewässer zurückgeführt.
- Graues Wasser beschreibt das Ausmaß der Wasserverschmutzung bei der landwirtschaftlichen sowie industriellen Produktion. Gemeint ist die Wassermenge, die notwendig wäre, um das von Dünge- und Pflanzenschutzmittel verunreinigte Wasser wieder zu neutralisieren.

10. **Wie viel virtuelles Wasser wird für ein Kg Rindfleisch verbraucht?**
- 55 Liter
- 15.500 Liter
- 150.000 Liter

11. **Was enthält mehr Zucker?**
- Schokolade
- Banane
- Ketchup

12. **Wie viel verdient eine Person, die T-Shirts herstellt, monatlich in Bangladesch**
- 1200 – 1500 Euro
- 650 – 750 Euro
- 30 – 60 Euro

Vielen Dank! Nun geht's ran an die APP – Viel Spaß!

Appendix II

Fragebogen Teil B

CHOIZ – Du hast es in der Hand

Schön, dass du immer noch dabei bist!
Bitte kreuze erneut an, inwiefern die Aussagen auf dich zutreffen. Bitte setze ein Kreuz pro Aussage.

13. In Zukunft ist es mir wichtig, auf meinen täglichen Wasserverbrauch zu achten.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

14. In Zukunft ist mir eine gesunde Ernährung im Alltag wichtig.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

15. In Zukunft ist mir nachhaltiges Handeln im Alltag wichtig.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

16. In Zukunft ist es mir wichtig, dass Lebensmittel nachhaltig hergestellt warden.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

***17.* In Zukunft ist es mir wichtig, dass Kleidung nachhaltig hergestellt wird.**

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

Teste dein Wissen erneut! Setze bei jeder Frage nur **EIN** Kreuz.

18. Das meiste Wasser, welches wir täglich verbrauchen, ist virtuelles Wasser. Was ist damit gemeint?

- Virtuelles Wasser „versteckt“ sich in Dingen, die wir täglich nutzen. Man braucht es, um z. B. Nahrungsmittel oder Kleidung herzustellen.
- Virtuelles Wasser wird benötigt, um unsere elektronischen Geräte in Betrieb zu halten: Computer, Fernseher, Telefon.
- Virtuelles Wasser meint das Wasser, das wir z. B. zum Blumengießen oder Autowaschen verwenden.

19. Wie hoch ist unser virtueller Wasserverbrauch in Deutschland pro Person/Tag?

- 3.900 Liter
- 230 Liter
- 3 Liter

20. Um die für die Erzeugung unserer Produkte gebrauchte Wassermenge zu berechnen, greifen Experten auf drei Kategorien zurück: Welche Definition beschreibt ‚graues Wasser'?

- Graues Wasser beschreibt das natürlich vorkommende Boden- und Regenwasser, das von den Pflanzen direkt aufgenommen wird oder verdunstet.
- Graues Wasser beschreibt die künstliche Bewässerung von landwirtschaftlichen Produkten. Dieses Produktionswasser wird dem Oberflächenwasser oder Grundwasser des Gebietes entnommen und anschließend nicht mehr in ein Gewässer zurückgeführt.
- Graues Wasser beschreibt das Ausmaß der Wasserverschmutzung bei der landwirtschaftlichen sowie industriellen Produktion. Gemeint ist die Wassermenge, die notwendig wäre, um das von Dünge- und Pflanzenschutzmittel verunreinigte Wasser wieder zu neutralisieren.

21. Wie viel virtuelles Wasser wird für ein Kg Rindfleisch verbraucht?

- 55 Liter
- 15.500 Liter
- 150.000 Liter

22. Was enthält mehr Zucker?

- Schokolade
- Banane
- Ketchup

23. Wie viel verdient eine Person, die T-Shirts herstellt, monatlich in Bangladesch

- 1200 – 1500 Euro
- 650 – 750 Euro
- 30 – 60 Euro

Nun möchten wir von dir wissen, was du von dem Thema und dem Prototyp der Schüler-App hältst. Bitte kreuze erneut an, inwiefern die Aussagen auf dich zutreffen. Bitte setze **ein** Kreuz pro Aussage.

24. Die Bedienung der App ist einfach.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

25. Ich finde mich in der App gut zurecht.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

26. Die App macht mich neugierig.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

27. Der Aufbau der App ist übersichtlich.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

28. Ich kann frei entscheiden, welches Nachhaltigkeitsziel ich bearbeite.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

29. Die Inhalte der App sind für mich gut verständlich

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

Weiterhin möchten wir gerne noch wissen, wie dir das Thema ‚17 Nachhaltigkeitsziele' gefällt. Bitte setze **ein** Kreuz pro Aussage /Frage.

30. Ich bin interessiert daran, mehr über das Thema Nachhaltigkeit zu erfahren.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

31. Ich bin interessiert daran, mehr über die Nachhaltigkeitsziele zu erfahren.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

32. Ich würde die fertig- entwickelte App nutzen.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

33. Könntest du dir vorstellen, dass die Nutzung der fertigen App zu nachhaltigem Verhalten beiträgt?

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

34. Ich würde die App auch in der Freizeit benutzen.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

35. Ich würde die fertige App meinen Freunden empfehlen.

trifft zu	trifft eher zu	trifft eher nicht zu	trifft nicht zu

36. Welche der drei Nachhaltigkeitsziele fandest du am spannendsten?

- 3 – Gesundheit und Wohlbefinden
- 6 – Wasser und Sanitäranlagen
- 12 – Nachhaltiger Konsum und Produktion

Fast geschafft – Zeit für ein paar letzte Anregungen. Deine persönliche Meinung ist uns sehr wichtig. Bitte beantworte die Fragen leserlich in Stichpunkten oder in Sätzen

37. Was an der App motiviert dich, weitere Ziele zu bearbeiten?

38. Was hat dir an der App am besten gefallen?

39. Was hat dir an der App gar nicht gefallen?

40. Was würdest du ändern?

41. Was würdest du dir zusätzlich in dieser App wünschen?

Geschafft!
Vielen Dank für die Teilnahme an unserer Befragung! Damit trägst du einen großen Beitrag zur Entwicklung und erfolgreichen Umsetzung von CHOIZ!

Stecke nun den Fragebogen in den Umschlag.

Appendix III

SPSS Syntax of statistical analysis

```
****DESCRIPTIVES
*descriptives of age and gender.
FREQUENCIES VARIABLES=Jahre Gender
  /STATISTICS=STDDEV MEAN
  /ORDER=ANALYSIS.

*age histogram.
DATASET ACTIVATE DataSet1.
FREQUENCIES VARIABLES=Jahre
  /HISTOGRAM
  /ORDER=ANALYSIS.

*descriptives of perceived importance of monitoring water consumption by grade and school.
CROSSTABS
  /TABLES=Klasse BY A2
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT ROW
  /COUNT ROUND CELL.

* descriptives of perceived importance of healthy nutrition by grade and school.
CROSSTABS
  /TABLES=Klasse BY A3
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT ROW
  /COUNT ROUND CELL.

* descriptives of perceived importance of sustainable action by grade and school.
CROSSTABS
  /TABLES=Klasse BY A4
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT ROW
  /COUNT ROUND CELL.

* descriptives of perceived importance of sustainably produced food.
CROSSTABS
  /TABLES=Klasse BY A5a
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT ROW
  /COUNT ROUND CELL.
```

```
  *descriptives of perceived importance of sustainably produced clothing.
 CROSSTABS
   /TABLES=Klasse BY A5b
   /FORMAT=AVALUE TABLES
   /CELLS=COUNT ROW
   /COUNT ROUND CELL.

  *descriptives of gender differences of perceived importance of monitoring water
consumption by grade and school.
 CROSSTABS
   /TABLES=Gender BY A2
   /FORMAT=AVALUE TABLES
   /STATISTICS=CHISQ
   /CELLS=COUNT ROW
   /COUNT ROUND CELL.

  *descriptives of gender differences of perceived importance of healthy nutrition by
grade and school.
  CROSSTABS
    /TABLES=Gender BY A3
    /FORMAT=AVALUE TABLES
    /STATISTICS=CHISQ
    /CELLS=COUNT ROW
    /COUNT ROUND CELL.

  *descriptives of gender differences of perceived importance of sustainable action by
grade and school.
    CROSSTABS
      /TABLES=Gender BY A4
      /FORMAT=AVALUE TABLES
      /STATISTICS=CHISQ
      /CELLS=COUNT ROW
      /COUNT ROUND CELL.

  * descriptives of gender differences of perceived importance of sustainably produced
food by grade and school.
 CROSSTABS
   /TABLES=Gender BY A5a
   /FORMAT=AVALUE TABLES
   /STATISTICS=CHISQ
   /CELLS=COUNT ROW
   /COUNT ROUND CELL.
```

```
  *descriptives of gender differences of perceived importance sustainably produced
clothing by grade and school.
  CROSSTABS
    /TABLES=Gender BY A5b
    /FORMAT=AVALUE TABLES
    /STATISTICS=CHISQ
    /CELLS=COUNT ROW
    /COUNT ROUND CELL.

  * descriptives of perceived importance of monitoring water consumption by grade
and school post-intervention.
  CROSSTABS
    /TABLES=Klasse BY B1
    /FORMAT=AVALUE TABLES
    /CELLS=COUNT ROW
    /COUNT ROUND CELL.

  * descriptives of perceived importance of healthy nutrition by grade and school post-
intervention.
  CROSSTABS
    /TABLES=Klasse BY B2
    /FORMAT=AVALUE TABLES
    /CELLS=COUNT ROW
    /COUNT ROUND CELL.

  * descriptives of perceived importance of sustainable action by grade and school
post-intervention.
  CROSSTABS
    /TABLES=Klasse BY B3
    /FORMAT=AVALUE TABLES
    /CELLS=COUNT ROW
    /COUNT ROUND CELL.

  * descriptives of perceived importance of sustainably produced food by grade and
school post-intervention.
  CROSSTABS
    /TABLES=Klasse BY B4a
    /FORMAT=AVALUE TABLES
    /CELLS=COUNT ROW
    /COUNT ROUND CELL.

  *descriptives of perceived importance of sustainably produced clothing by grade and
school post-intervention.
  CROSSTABS
    /TABLES=Klasse BY B4b
    /FORMAT=AVALUE TABLES
    /CELLS=COUNT ROW
    /COUNT ROUND CELL.
```

```
****NONPARAMETRIC TESTS: RELATED SAMPLES
  SORT CASES  BY Schule.
  SPLIT FILE LAYERED BY Schule.

  *Nonparametric Tests: Related Samples. Comparison of perceived importance pre-post-intervention.
  NPAR TESTS
    /WILCOXON=A2 A3 A4 A5a A5b WITH B1 B2 B3 B4a B4b (PAIRED)
    /MISSING ANALYSIS.

  NPAR TESTS
    /WILCOXON=A2 WITH B1 (PAIRED)
    /MISSING ANALYSIS.

  *Nonparametric Tests: Related Samples. Comparison of perceived importance of monitoring daily water consumption pre-post-intervention.
  NPTESTS
    /RELATED TEST(A2 B1) WILCOXON
    /MISSING SCOPE=ANALYSIS USERMISSING=EXCLUDE
    /CRITERIA ALPHA=0.05  CILEVEL=95.

  *median shift of perceived importance of perceived importance of monitoring daily water consumption pre-post-intervention.
  FREQUENCIES VARIABLES=B1 A2
    /STATISTICS=MEDIAN
    /ORDER=ANALYSIS.

  *Nonparametric Tests: Related Samples. Comparison of perceived importance of healthy nutrition pre-post-intervention.
  NPTESTS
    /RELATED TEST(A3 B2) WILCOXON
    /MISSING SCOPE=ANALYSIS USERMISSING=EXCLUDE
    /CRITERIA ALPHA=0.05  CILEVEL=95.

  *median shift of perceived importance of healthy nutrition pre-post-intervention.
  FREQUENCIES VARIABLES=A3 B2
    /STATISTICS=MEDIAN
    /ORDER=ANALYSIS.

  *Nonparametric Tests: Related Samples. Comparison of perceived importance of sustainable action pre-post-intervention.
  NPTESTS
    /RELATED TEST(A4 B3) WILCOXON
    /MISSING SCOPE=ANALYSIS USERMISSING=EXCLUDE
    /CRITERIA ALPHA=0.05  CILEVEL=95.
```

```
  *median shift of perceived importance of sustainable action pre-post-intervention.
   FREQUENCIES VARIABLES=A4 B3
   /STATISTICS=MEDIAN
   /ORDER=ANALYSIS.

  *Nonparametric Tests: Related Samples. Comparison of perceived importance of
sustainably produced food pre-post-intervention.
  NPTESTS
   /RELATED TEST(A5a B4a) WILCOXON
   /MISSING SCOPE=ANALYSIS USERMISSING=EXCLUDE
   /CRITERIA ALPHA=0.05  CILEVEL=95.

  *median shift of perceived importance of sustainably produced food pre-post-
intervention.
  FREQUENCIES VARIABLES=A5a B4a
   /STATISTICS=MEDIAN
   /ORDER=ANALYSIS.

  *Nonparametric Tests: Related Samples. Comparison of perceived importance of
sustainably produced clothing pre-post-intervention.
  NPTESTS
   /RELATED TEST(A5b B4b) WILCOXON
   /MISSING SCOPE=ANALYSIS USERMISSING=EXCLUDE
   /CRITERIA ALPHA=0.05  CILEVEL=95.

  *median shift of perceived importance of sustainably produced clothing pre-post-
intervention.
  FREQUENCIES VARIABLES=A5b B4b
   /STATISTICS=MEDIAN
   /ORDER=ANALYSIS.


  ****GRAPHS
  *Table for frequency of perceived importance of monitoring daily water consumption
pre-intervention, creating stacked bar charts from table.
  CTABLES
   /VLABELS VARIABLES=Klasse A2 DISPLAY=LABEL
   /TABLE Klasse [C][ROWPCT.COUNT PCT40.1] BY A2 [C]
   /SLABELS VISIBLE=NO
   /CATEGORIES VARIABLES=Klasse A2 ORDER=A KEY=VALUE EMPTY=INCLUDE
   /CRITERIA CILEVEL=95.
```

```
  *Table for frequency of perceived importance of healthy nutrition pre-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse A3 DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY A3
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse A3 ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.

  *Table for frequency of perceived importance of sustainable action pre-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse A4 DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY A4
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse A4 ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.

  *Table for frequency of perceived importance of sustainable produced food pre-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse A5a DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY A5a
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse A5a ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.

  *Table for frequency of perceived importance of sustainable produced clothing pre-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse A5b DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY A5b
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse A5b ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.


  *Table for frequency of perceived importance of monitoring daily water consumption post-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse B1 DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY B1
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse B1 ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.
```

```
  *Table for frequency of perceived importance of healthy diet post-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse B2 DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY B2
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse B2 ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.

  *Table for frequency of perceived importance of sustainable action post-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse B3 DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY B3
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse B3 ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.

  *Table for frequency of perceived importance of sustainably produced food post-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse B4a DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY B4a
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse B4a ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.

  *Table for frequency of perceived importance of sustainably produced clothing post-intervention, creating stacked bar charts from table.
  CTABLES
    /VLABELS VARIABLES=Klasse B4b DISPLAY=LABEL
    /TABLE Klasse [ROWPCT.COUNT PCT40.1] BY B4b
    /SLABELS VISIBLE=NO
    /CATEGORIES VARIABLES=Klasse B4b ORDER=A KEY=VALUE EMPTY=INCLUDE
    /CRITERIA CILEVEL=95.
```

```
  *create new variables of knowledge assessment of questionnaire A & B, dichotomised (correct=1 and false=2).
  RECODE A6 B6 (1=1) (ELSE=2) INTO A6di B6di.
  VARIABLE LABELS  A6di 'Virtuelles Wasser' /B6di 'Virtuelles Wasser'.
  EXECUTE.
  RECODE A7 B7 A8 B8 A9 B9 A10 B10 A11 B11 (1=1) (ELSE=2) INTO A7di B7di A8di B8di A9di B9di A10di
     B10di A11di B11di.
  VARIABLE LABELS  A7di 'Virtueller Wasserverbrauch' /B7di 'Virtueller Wasserverbrauch' /A8di
     'Graues Wasser' /B8di 'Graues Wasser' /A9di 'Wasserverbrauch Rindfleisch' /B9di 'Wasserverbrauch '+
     'Rindfleisch' /A10di 'Zucker' /B10di 'Zucker' /A11di 'Lohn Bangladesch' /B11di 'Lohn Bangledasch'.
  EXECUTE.

  RECODE A7 B7 (1=1) (ELSE=2) INTO A7di B7di.
  VARIABLE LABELS  A7di '3.900 l' /B7di 3.900 l.
  EXECUTE.

  RECODE A8 B8 (3=1) (ELSE=2) INTO A8di B8di.
  VARIABLE LABELS  A8di 'Graues Wasser' /B8di 'Graues Wasser'.
  EXECUTE.

  RECODE A9 B9 (2=1) (ELSE=2) INTO A9di B9di.
  VARIABLE LABELS  A9di 'Rindfleisch' /B9di 'Rindfleisch'.
  EXECUTE.

  RECODE A10 B10 (3=1) (ELSE=2) INTO A10di B10di.
  VARIABLE LABELS  A10di 'Zucker' /B10di 'Zucker'.
  EXECUTE.

  RECODE A11 B11 (3=1) (ELSE=2) INTO A11di B11di.
  VARIABLE LABELS  A11di 'Lohn Bangladesch' /B11di 'Lohn Bangladesch'.
  EXECUTE.

  *create new variables, sum of correct answers questionnaire A, dichotomised (correct=1 and false=2).
  COUNT Arich=A6di A7di A8di A9di A10di A11di(1).
  VARIABLE LABELS  Arich 'A richtige Antworten'.
  EXECUTE.
```

```
*create new variables, sum of correct answers questionnaire B, dichotomised (correct=1 and false=2).
COUNT Brich=B6di B7di B8di B9di B10di B11di(1).
VARIABLE LABELS  Brich 'B richtige Antworten'.
EXECUTE.

*change in knowledge pre-post-intervention.
T-TEST PAIRS=Arich WITH Brich (PAIRED)
  /CRITERIA=CI(.9500)
  /MISSING=ANALYSIS.

*Table for frequency of interest in sustainability post-intervention, creating pie charts from table split by school.
CTABLES
  /VLABELS VARIABLES=Schule B18 DISPLAY=LABEL
  /TABLE Schule [ROWPCT.COUNT PCT40.1] BY B18
  /SLABELS VISIBLE=NO
  /CATEGORIES VARIABLES=Schule B18 ORDER=A KEY=VALUE EMPTY=INCLUDE
  /CRITERIA CILEVEL=95.

*Table for frequency interest in learning more about the Sustainable Development Goals post-intervention, creating pie charts from table split by school.
CTABLES
  /VLABELS VARIABLES=Schule B19 DISPLAY=LABEL
  /TABLE Schule [ROWPCT.COUNT PCT40.1] BY B19
  /SLABELS VISIBLE=NO
  /CATEGORIES VARIABLES=Schule B19 ORDER=A KEY=VALUE EMPTY=INCLUDE
  /CRITERIA CILEVEL=95.

*Table for frequency of perceived contribution of the app to promote sustainable behaviour, creating pie charts from table split by school.
CTABLES
  /VLABELS VARIABLES=Schule B21 DISPLAY=LABEL
  /TABLE Schule [ROWPCT.COUNT PCT40.1] BY B21
  /SLABELS VISIBLE=NO
  /CATEGORIES VARIABLES=Schule B21 ORDER=A KEY=VALUE EMPTY=INCLUDE
  /CRITERIA CILEVEL=95.

*Table for frequency of Motivation to use Choiz! in student's leisure time, creating pie charts from table split by school.
CTABLES
  /VLABELS VARIABLES=Schule B22 DISPLAY=LABEL
  /TABLE Schule [ROWPCT.COUNT PCT40.1] BY B22
  /SLABELS VISIBLE=NO
  /CATEGORIES VARIABLES=Schule B22 ORDER=A KEY=VALUE EMPTY=INCLUDE
  /CRITERIA CILEVEL=95.
```