

Exploring ways for experts & students to 'connect' in Education for Sustainable Development

Karin Brezet

Supervisors

Donald Huisingh

Mikael Backman

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Abstract

High school educators and administrators are increasingly concerned about educating and engaging their students in sustainability issues. Consequently, curricula in many schools are being redesigned in order to focus upon these issues and their consequences. This thesis describes a project, 'Scholen voor Duurzaamheid' (Schools for Sustainability, SvD), that is being used as a springboard in Dutch high schools to gain experience in Education for Sustainable Development (ESD) and investigate how Information & Communication Technology (ICT)-tools can support the effective integration of experts' tacit knowledge in the classroom. Changing roles of both ICT and experts form two of the golden threads throughout this thesis.

This thesis author first connected the different underlying theoretical aspects of the three main areas through the construction of a conceptual model. This model helped the author to organize the different theories of the literature review into a logical manner and led to the creation of different propositions, which were used to focus and guide the empirical data gathering.

Case studies were performed both in high schools that participated in the SvD project and in ESD programmes which offer courses through the use of ICT and are planning to offer or are offering the possibility for students to get in contact with experts. Examination of these cases was designed to assess if the contributions of experts are considered to be valuable for the educational process and if they help to achieve the desired student learning outcomes. Secondly, the thesis author looked into the way experts are contacted with the help of ICT. Thirdly, several anticipated difficulties were examined that could arise through the use of ICT-tools and how to overcome those challenges; keeping in mind that there are communication differences between students and experts.

The findings of the research helped this thesis author to prepare several recommendations for actors (in this case with regard to: non-governmental organizations (NGOs), students, high school educators and experts) that are involving, or may wish to involve experts and ICT in improving the effectivity of high school ESD education.

Executive Summary

The United Nations (UN) has been concerned with sustainable development for almost three decades now. In 1983, the United Nations World Commission on Environment and Development (UNWCED) was created with the mandate to help societies to become aware of and engaged in the crucial activities needed to make the transition to sustainability. Education, according to the UN, is essential to work towards this goal. This focus eventually led to the establishment of education referred to as ESD.

Important actors in this field include but are not limited to: NGOs that help to integrate ESD into the classroom, experts with extensive knowledge, the UN and its organizations, educators, administrators and parents. An example of one NGO involved in ESD in the Netherlands is 'IVN Natuur- en milieueducatie' (IVN). It has developed a project that is being introduced throughout the Netherlands. The overall objective of the SvD project is to provide students between the ages of 12 – 18 experience with actual, concrete societal problems, which need holistic, multi-disciplinary approaches to 'solve' them. Several different resources are provided to the students, such as the possibility to talk to and interview representatives of companies, organizations or the government.

The SvD project was designed to deliver innovative ESD, to offer a dynamic program and time savings for educators. ICT approaches and -tools can be very useful in this respect, especially when it comes to providing communication possibilities between students and experts. This thesis investigates ways of integrating different ICT approaches into the educational process of projects such as SvD, which can be beneficial for NGOs like IVN and more importantly for improving quality and efficiency in educating high school students on environmental issues pertaining to sustainability and related issues.

The method used within this thesis is case research, which involved literature reviews, interviews and direct, in school observations. The reviews of the literature provided this author the insight to create a conceptual model on the process of the utilization of ICT-tools and experts in facilitating high school students with valuable learning experiences. This model diagrammatically, includes the important parts and connections that were revealed within the literature. Through the use of the model, more specific and structured questions were created which led to the creation of several propositions to guide the empirical data research.

The literature review examined the areas of ESD, experts' knowledge and ICT-tools that could provide added value to the incorporation of such knowledge within the educational process. The United Nations Educational, Scientific and Cultural Organization (UNESCO) emphasizes the importance of the reorientation of formal education, curricula and policies towards ESD in order to reach desired attitude and behavioral changes. Many different approaches to ESD have been developed. Several of these approaches, which included the involvement of experts, were especially examined in this thesis research.

Experts, however, differ widely from students, especially when it comes to the differences in their vocabulary and their knowledge. Experts possess extensive tacit knowledge that is hard to share with others. Explicit knowledge, on the other hand, is easier to share. The conversion of tacit to explicit knowledge can take place through the different modes of socialization, externalization, combination and internalization, which is also referred to as the SECI-process. In order to convert tacit into explicit knowledge, a 'field' will have to be created which allows face-to-face contact of individuals. This way, individuals can share mental models and body language, finally allowing tacit knowledge to be converted into explicit concepts.

All ICT-tools have some present limitations when it comes to facilitating the sharing of experts' tacit knowledge with students and educators. A method that allows the filming of experts in order to more effectively 'capture' this tacit knowledge has been investigated. Additionally, ICT-tools that allow more direct communication links with students were identified. The most important parts and theories of the literature review led this author to develop the following conceptual model, which is represented in Figure 0-1:

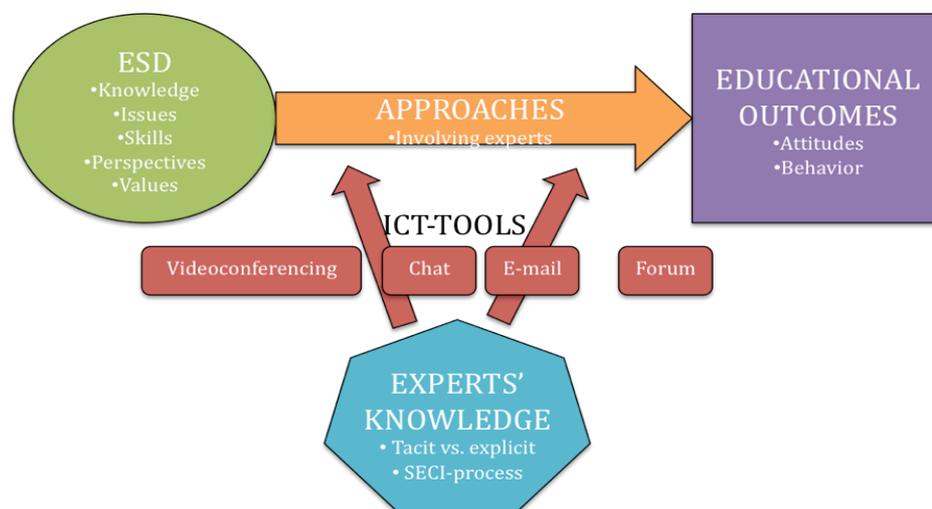


Figure 0-1 Conceptual model

Different propositions were developed and tested on the basis of this model and these propositions were used to structure the empirical research, which consisted of two case studies conducted at different high schools and the examination of ESD programmes which include the use of ICT-tools and experts' knowledge or which are planning to integrate such approaches into their course.

Professionals working at high schools indicated that the contribution of experts is valuable for the educational process. Students, who had contacted experts, also found the feedback they received important for their project work. Most students' groups had used e-mail to contact experts. Only once was the provided information by a cooperating expert partially too complicated to use for the students. The IVN-expert, who was interviewed, also said that e-mail was his preferred communication tool if he would cooperate in the SvD project. When it comes to his role in the project, this expert indicated that he would like to challenge students to question their living surroundings, the way things are arranged and how things can be improved.

Three ESD programmes (the Young Masters Programme (YMP), Energy for Sustainable Development (E4SD) and OPEDUCA) were examined which use ICT-tools in their programmes and offer or are planning to offer the incorporation of experts' knowledge into the educational process.

The YMP is a good example of the youth being involved in sustainability issues through distance education. The YMP facilitators acknowledged that solving such issues is not a linear process. Students should jointly work together on complex issues, allowing creativity and a whole range of ICT-based facilities to support their efforts. The YMP course intends, in a later phase, to introduce students to different resources including knowledge bases, research methods, interviews with researchers, background documents and communities of feedback.

The E4SD course shows that it is important to have certain preconditions when organizing the involvement of experts through the use of ICT.

Finally, the OPEDUCA programme offers 'Flights for Knowledge' which offer thematic approaches and build continuous learning lines. The youth knows much about the range of possibilities that ICT has to offer; therefore, it is the obligation of educational organizations offering ESD to innovate and build upon these skills of their students. In this programme's view, it is the student who chooses which ICT-tool he/she wants to use to contact the expert, and even if this expert is, in a manner of speaking, located in the middle of nowhere, the expert will only need the right electronic equipment to be able to contribute to the teaching process.

The literature and the data collection showed that the contributions of experts are regarded to be positive for the educational process. Several approaches were identified that allowed students to go on field trips and make personal connections with experts. However, as ICT-tools are improved to become faster, better and cheaper, certainly the younger generations will not have difficulties in adapting to work and deal with the newest gadgets and developments in this area. Such a combination makes it essential that educators, NGOs and experts utilize ICT approaches and -tools, increasingly effectively in and out of classroom contexts, especially on ESD.

The different ESD programmes that were examined use several approaches in order to integrate ICT into the teaching process. When students are encouraged to contact experts in a direct way, it is important that teachers are available to support this process. Even though the literature acknowledges that rich media tools, more and more, create the possibilities for expressing tacit knowledge between persons who are communicating through the use of ICT, it is only the question how much of such knowledge can be really understood and grasped by high school students in for example a videoconferencing call of half an hour. Furthermore, practical dilemmas, like time issues, would prohibit an expert from cooperating with such a meeting in the first place. It is therefore important that experts, who volunteer to cooperate in a project such as SvD, know on forehand how much time such involvement is going to cost them and are well prepared for their tasks.

The differences between students and experts, the characteristics of tacit knowledge and the goals of an ESD approach such as the SvD project require reorientation on the role of experts in such projects, next to the roles that IVN ascribes to them. Several recommendations are made with respect to ICT approaches that facilitate the integration of experts' knowledge into the educational process. Also, several general recommendations are made.

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1 Introduction

This chapter introduces the reader to the problem analysis, the research question and sub questions, the scope and limitations, the structure and the audience of this thesis.

1.1 Background

The concept of sustainable development (SD) has been a concern of the United Nations (UN) for more than 25 years now. In 1983, the United Nations World Commission on Environment and Development (UNWCED or 'Brundtland' Commission) was created with the mandate to help societies to become aware of and engaged in the crucial activities needed to make the transition to sustainability. This Commission published a book, 'Our Common Future' (United Nations World Commission on Environment and Development [UNWCED], 1987) that was accepted by the General Assembly on December 1987 in Resolution 42/187 (United Nations General Assembly [UNGA], 42nd session).

Our Common Future contains the most often quoted definition of SD:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Education, according to the UN, is an essential instrument to help societies achieve sustainable development. This focus eventually led to the establishment of education referred to as *Education for Sustainable Development* (ESD). The urgency to proceed to make high quality educational strategies and courses was underscored when leaders of diverse UN organizations decided to devote a whole Decade, running from 2005 until 2014, to this concept. This Decade of Education for Sustainable Development (DESD) has the United Nations Educational, Scientific and Cultural Organization (UNESCO) as its main lead organization in achieving the objectives of the DESD.

Resolution 57/254 of the General Assembly (UNGA, 57th session), which declared the DESD to come officially into existence, assigned UNESCO the responsibility to draw up an International Implementation Scheme (IIS) together with the help of several actors, such as non-governmental organizations (NGOs). These organizations are expected to have ideas and a vision about the integration of ESD into the educational systems of their Governments and it is therefore not remarkable that NGOs should be involved in the process of creating such an International Implementation Scheme. The UNESCO Executive Board accepted such a Scheme in September 2005 (United Nations Educational, Scientific and Cultural Organization [UNESCO], n.d.). The IIS emphasizes that formal education institutions will have to collaborate with the non-formal education sector in order to create appropriate ESD programmes (UNESCO, 2005a). NGOs can therefore be regarded as important actors when it comes to integrating ESD into the classroom.

An example of such an NGO involved in ESD in the Netherlands is for instance 'IVN Natuur- en milieueducatie' (IVN). This NGO has developed a project, 'Scholen voor Duurzaamheid' (Schools for Sustainability, SvD), which is being implemented in high schools throughout the Netherlands. One aspect of the project is the involvement of experts in the teaching process. IVN considers such involvement to be of added value for the project. A more in-depth description of IVN and the SvD project is presented in Chapter 3.

The role of the teacher in the classroom is changing, which is also accelerated by experts taking part in the teaching process. The role of teachers is transforming from being the ultimate knowledge source into being the motivator of students and their different skills. This view is also supported when it comes to teachers and their role in educating ESD (see for example Scoullos & Malotidi, 2004 and UNESCO, 2009). Skills such as knowledge gathering, fostering independent thinking and learning how to work with Information & Communication Technology¹ (ICT)-based facilities are all becoming increasingly important for students, as they become equal players now and later as they become personally and professionally involved in helping to make the transition to societal sustainability.

The SvD project also connects importance to these different skills. Other aspects of the SvD project are that it tries to, amongst other things, deliver innovative education, offer a dynamic program and is timesaving for teachers. ICT can help to achieve these goals of the project. Students need to use different ICT facilities in order to get in touch with experts and to learn from their experiences and knowledge. It is important however to realize that experts possess different kinds of knowledge and difficulties can arise when such knowledge is integrated into the teaching processes of high schools.

This background analysis can be depicted as a funnel (Figure 1-1):

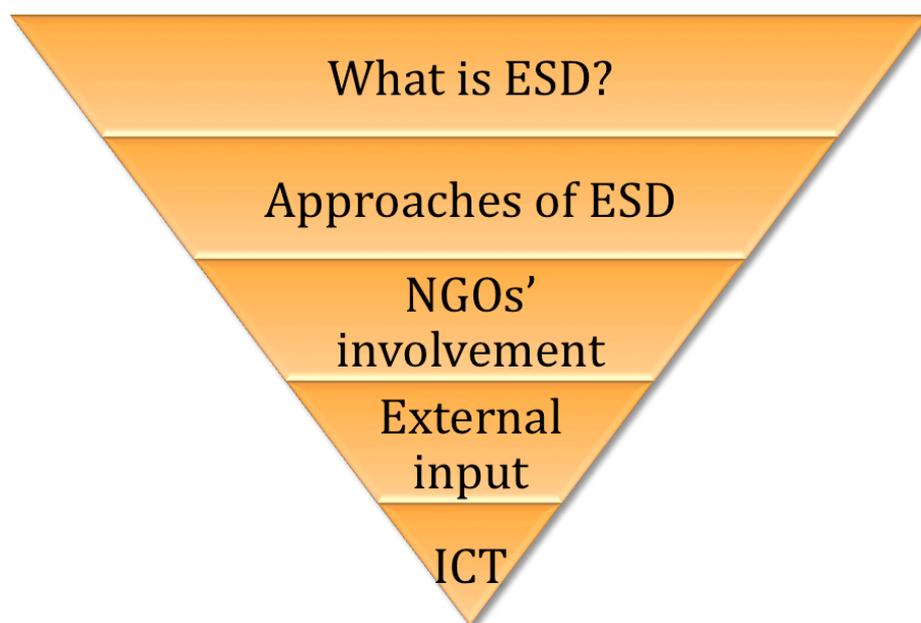


Figure 1-1 Background analysis

1.2 Research Question

The main research question of this thesis is:

¹ The term ICT can be applied to information handling taking place in an electronic manner, where the 'C' in this abbreviation illustrates the communication part. ICT includes hardware such as Personal Computers (PCs) and telephones and software to run these devices (Arnfolk, 2002).

“How can ICT approaches² support the integration of experts’ knowledge into high-school sustainability (-ESD-) projects of NGOs?”

In order to be able to answer this overall research question, it was further divided into the following four sub questions:

1. What is ESD and what are examples of ESD approaches that utilize the contributions of experts?
2. How are NGOs actively engaged in offering ESD to high schools?
3. What type(s) of knowledge do experts possess?
4. Which ICT-tools³ can be identified as having added value for the teaching process, especially when it comes to incorporating experts’ knowledge into this process?

1.3 Scope

This thesis focuses upon ICT approaches that can be useful for ESD in high schools. In order to be able to answer the main research question and sub questions, this thesis will identify ICT-tools that can help with incorporating experts’ knowledge into the ESD educational process. The three sub questions derived from the main research question, namely ICT, expert knowledge and ESD could all be the subjects of PhD theses. It is therefore not the intention of the author to cover them in full extent. The main focus in this thesis will therefore be on ICT. These areas however, mainly serve as a foundation to support the main research. Short contextual reviews of these areas are integrated as supportive materials for the primary research area of this thesis.

The theories discussed in this thesis are applicable not only in the Dutch system but also in educational systems that are similar to it. A main aspect of the Dutch educational system is that it is decentralized (Scoullos & Malotidi, 2004). Schools are financially supported by the Dutch government and have their own responsibility for the offered contents in the curricula. However, the government does expect a certain output of the schools. Schools can and should also be able to offer enough ICT support for students.

1.4 Audience

The research for this thesis was performed through an internship, which was provided to the thesis author by IVN. This thesis is therefore especially relevant for this Dutch NGO and for the Dutch high school educational system. The research findings can also be of relevance for diverse actors involved in ESD and the integration of ICT into the educational system. Hereby can be thought of high school educators, NGOs and other organizations dealing with issues connected to ESD.

² ICT approaches support the integration of experts’ knowledge into ESD education through the use of ICT. They must, however, be used keeping in mind all the different interests of the identified actors in such a process (NGOs, high schools, students and experts).

³ ICT-tools, according to Bataineh & Tubaishat (2009), can be used in a ‘technology mediated learning environment [...] to communicate, collaborate and share resources; these tools provide anytime and anywhere learning opportunities.’

1.5 Structure

This thesis is structured as follows.

CHAPTER	Contents
2	Describes the methodology, including research design, case studies and data collection.
3	Introduces the reader to IVN and the SvD project.
4	Provides a broad overview of the relevant literature and creates a conceptual model.
5	Describes the case studies.
6	Describes the different ESD programmes which use ICT in their education.
7	Provides a discussion and analysis on the main findings.
8	Gives the conclusion and recommendations.

Table 1-1 Thesis outline

2 METHODOLOGY

This chapter introduces the reader to the research design of this thesis. The findings from the literature review, empirical data gathering and analysis used in the thesis are discussed.

2.1 Research Design & Method

It is first of all important for the author to recognize that writing a thesis is never a static process but instead a very dynamic and iterative undertaking, which is also expressed in Figure 2-1:

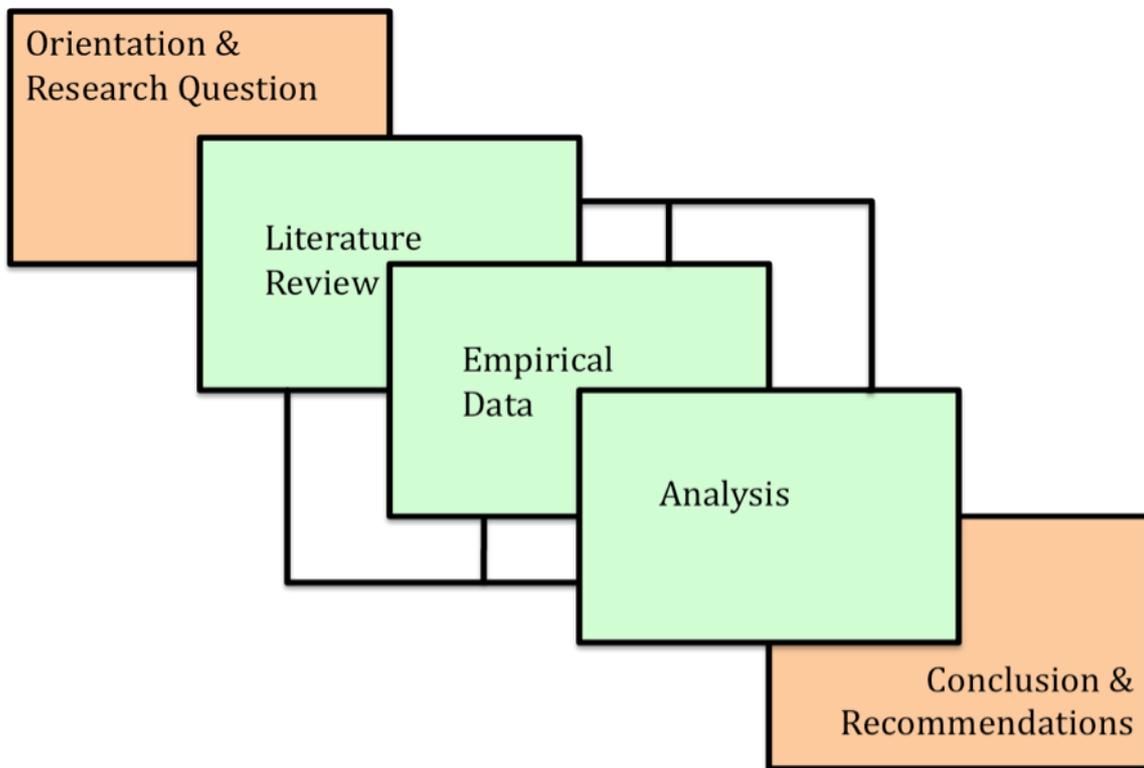


Figure 2-1 Research design

A preliminary orientation is first of all important to identify the relevance of the research topic. The creation of a research question shows in what way the literature review subsequently should be examined. The outcomes to this literature review allow the possibility to create a conceptual model and develop propositions, which, in their turn, can be tested by the examination of empirical data gathering. Finally, an analysis of all the relevant results will allow the author to draw conclusions and make recommendations.

The method that is used within this thesis is in the form of a case research, which method can, according to Mont, consist of several things, such as e.g. a literature review, questionnaires, interviews, focus groups, workshops and observations (Mont, 2004). The case study research in this thesis involved literature review, interviews and observations.

2.2 Literature Review

The author has performed a literature analysis. The most important sources consisted of articles from different types of journals, books and IVN documents and reports. Also online sources of different relevant organizations, topics and issues, were consulted.

The focus of this literature review was upon what scholars have written about ICT-tools that have an identified relevance when experts' knowledge is integrated into the educational process. References used within these sources led to other appropriate sources useful for the research. IVN documents and reports were used to describe the organization and the SvD project.

2.3 Empirical Data

The author has gathered empirical data through examining cases at:

- High schools; and
- ESD programmes working with ICT.

The author of this thesis first of all went to the 'Scholen voor Duurzaamheid' meeting held by IVN district South Holland on 19 May 2009. Observations were made when different high school students gave their presentations and the interactions between students and experts were observed. The author also talked to several high school students and their teachers. This allowed her to make a selection of high schools that would be suitable to cooperate in the empirical data process. An important selection criterion for the author was the consideration that selected high schools had actually received relevant inputs from experts in their project works. Two high schools were selected on basis of this criterion for the case studies.

These case studies will show the reader how the SvD project is integrated into high school curricula, by providing a general idea about the practical and other issues students and teachers have in respect to implementation and execution of the project. The examination of these cases also shows how experts are involved in the educational setting.

Also, empirical data gathering was done amongst programmes that work with ICT in order to offer ESD; interviews were held amongst relevant persons and organizations in the field. These persons are all working for organizations that offer ESD to students with the help of ICT-tools and were chosen through the use of the 'snowball method'. Their relevance for the thesis research was indicated by for example thesis supervisors. These interviewees then pointed out other relevant persons that would be important to interview for the research.

The author conducted a total of 19 qualitative interviews with the help of (semi-structured) questionnaires. The interviews were recorded, transcribed and sent to the interviewee in order to verify whether the contents were correctly interpreted. Interviews which were held in the author's mother tongue, Dutch, were translated into English.

2.4 Analysis

Analysis of the obtained data was performed in the following way.

Both the literature review and empirical data gathering were done in order to find answers for the four sub questions posed in chapter 1 (see section 1.2 'Research Question'). The following Table 2-1 shows where the literature review presents answers to the different sub questions:

Sub question \ Chapter	1	2	3	4
3		X		
4	X		X	X

Table 2-1 Analysis of answers to sub questions based upon the literature review

The answers to these sub questions allowed the author to create a conceptual model. Conceptual models, according to Järvelin and Wilson (2003), identify fundamental parts and elements of the studied system and indicate how changing these parts and their relationships influences the functioning of such a system. In this case, the review of the literature and the answers to the different sub questions allowed the thesis author to create such a conceptual model. This model indicates the important parts and connections that came up after the conducted literature review and allowed the author to structure the different relevant parts and connections.

Relevant follow up questions, propositions, were then identified which needed more specific examination and therefore needed to be addressed within the empirical data gathering. The results of this empirical data gathering permitted the author to adjust, fine-tune and elaborate on the initial outcomes in order to provide a final answer to the main research question of this thesis.

2.5 Limitations

The thesis author does not specifically address knowledge transfer or pedagogical issues. Also, it is not the objective of the author to specifically define 'success' in terms of involvement of external knowledge inputs. This author therefore does not look at the learning outcomes because several constraints do not allow her to create a test group and a control group through which the results can comparatively be validated. However, indicative findings, appropriate for further testing could be expected.

Limitations can also lie in the method used for the case research. Riege (2003) for example mentions that confirmability and dependability can be doubtful when it comes to case study research. Confirmability deals with the subjectivity that researchers can possess and which could influence the performed research when data is being collected. Credibility involves the agreement of interviewees to the research findings. Transferability deals with the generalization of research findings and how the outcomes to a specific case are generalized. Dependability has to do with the consistency of the conducted research. Quantitative techniques, ensuring construct validity, internal and external validity and reliability, can also be applied on case studies according to Riege (2003).

Riege gives examples of techniques, which can help with creating objectivity within case study research. Several of these techniques have been used by the author such as making use of

multiple resources during the data collection to prevent researcher bias, revision of drafts by supervisors, transcription of interviews and verification of these reports by interviewees, indication of scope and boundaries in the thesis, comparison of the findings from the empirical data gathering with literature and finally recordings of interviews with a mechanical device that were conducted in the light of this thesis.

3 IVN

Chapter 3 introduces several aspects of the Dutch non-governmental organization IVN and its project SvD.

3.1 The Organization

IVN is a Dutch NGO with the primary objective to contribute to a sustainable Dutch society by educationally involving people in nature and environmental surroundings. Communication, education and participation are primary means used by IVN in order to achieve its objective. IVN was created in 1960 and now consists of both paid employees and volunteers (approximately 17.000), whose work leads to a broad range of products and services. The organization often collaborates with other, similar, organizations, such as educational institutions and governments (IVN, n.d.).

Three main legs of IVN are volunteers, 'natuur- en milieueducatie' (NME or nature- and environmental education) and landscape management, which legs function as driving factors for IVN and are depicted in Figure 3-1:

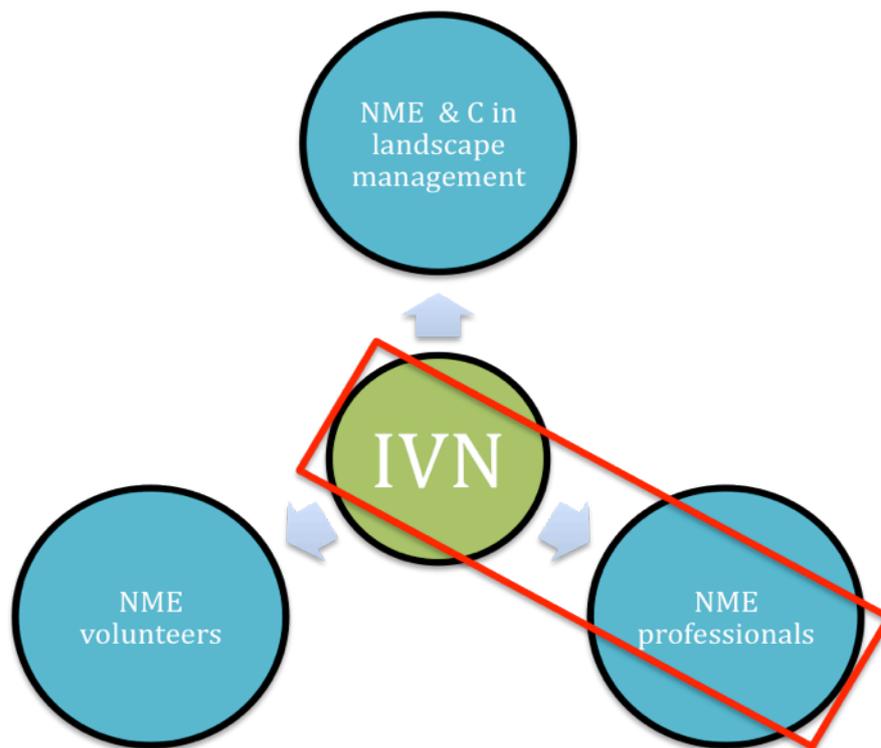


Figure 3-1 Three main legs IVN

The first leg, “NME volunteers”, includes volunteers who take part in local communities and are conducting nature- and environmental education and consists of a whole range of activities (e.g. excursions) that can be undertaken. The NME volunteers can also support the SvD project on an incidental basis. The second leg, “NME professionals”, has a supportive and advising role towards organizations involved in NME. Such NME organizations function at a local and/or municipal level while IVN operates on a provincial level. It is this leg, also indicated by the red box in Figure 3-1, which will be the research focus of this thesis. IVN, in

its third leg, has the responsibility as “landscape manager”, coordinating educational information facilities within seventeen existing Dutch national parks.

The organization of IVN consists of an association and a foundation (see for a representation of IVN’s organizational structure Figure 11-1 in the Appendix of this thesis). The association is a voluntary organization. It has a board of directors and members, which are the volunteers. The foundation, formed by the professional organization within IVN, does not have members but approximately 100 employees. These employees are divided over 12 ‘Consulentschappen’ (regional offices), each representing one specific province in the Netherlands, and the head office located in Amsterdam. The professional organization operates on a much broader scale than the association in the fields of nature and sustainability; it also establishes and supports projects such as ‘Duurzame Dinsdag’ (Sustainable Tuesday) and the SvD project, which forms the main research topic of this thesis.

3.2 Scholen voor Duurzaamheid

Collaboration between IVN and Dutch high schools has led to the creation of the project-based initiative SvD. The second leg of IVN aims at strengthening the role and quality of SD education in Dutch high schools. Introducing SvD into classrooms helps IVN to achieve this. The SvD project, through involving adolescents in actual sustainability issues with the use of a solid educational approach, also helps IVN to achieve its broader objective to contribute to a durable society by involving people in nature and environmental engagement. This is summarized in Figure 3-2:

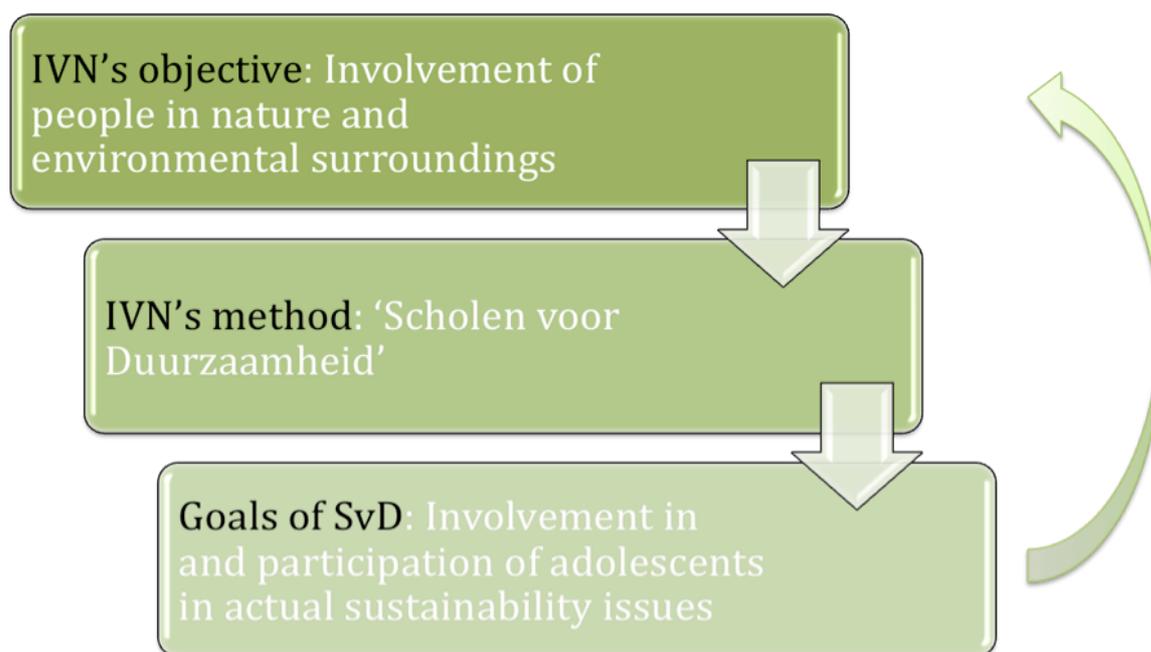


Figure 3-2 Goals of SvD

SvD projects are being implemented throughout the Netherlands. Project specific programmes have been developed for several provinces (Van der Waal & Wals, 2009). IVN connects, per province, questions of schools to educational needs of social partners. Between 2001 and 2008, SvD reached 24.000 students throughout the Netherlands. IVN is the driving factor behind the project. Implementation of the project within high schools is however left to

the different NME organizations that form a link between IVN and these schools. Initiators of the SvD project are, amongst others, companies or regional departments of the Dutch governments.

Aspects of the SvD project are that it offers:

- Innovative education offering quality and depth;
- Actual, relevant topics;
- Challenges for students at all levels;
- A logical structure of courses;
- Inspiring examples of project-education;
- Time savings for teachers; and
- A dynamic program (Scholen voor Duurzaamheid [SvD], n.d.).

The overall objective of the SvD project is that high school students, between the ages of 12 – 18, should be provided with actual, concrete societal problems and are asked to solve these problems in groups. Several different resources, in the form of literature and the opportunity to talk to and interview representatives of companies, organizations or the government, are offered to the groups. Experts are, in this way, directly involved in the teaching process and students are, in a significant manner, brought into contact, through these experts, by looking jointly for solutions to current societal challenges. The program aims at passive attitude change.

Underlying purposes of the project are acquiring specialized knowledge and practicing to build skills such as information gathering, discussing, learning how to cooperate and presenting their findings (Van der Waal & Wals, 2009).

3.3 SvD in South Holland

South Holland uses the method of 'Verhalend ontwerpen' (Storyline approach) to develop and to practice the above-mentioned skills. This approach, an inquiry-based teaching method, initiates imagination and builds upon prior experiences and knowledge through the telling of a story (Isabelle, 2007).

The storyline approach is based upon the constructivist theory. This theory about 'how learners learn' (Robottom, 2004), states that an individual learner actively constructs his/her knowledge on a basis of what is already understood (Pritchard, 2005). Much emphasis within this theory is placed upon learners constructing personal meaning to their activities which, rather than knowledge-acquisition strategies, supports learning (Hammond & Trapp, 2001).

According to Scoullos & Malotidi (2004) constructivism has, when it comes to environmental education, advantages over the traditional educational approach with a teacher-centered class. Table 3-1 has been designed by the author to list the advantages of the constructivist approach for students and the different roles that are expected of teachers:

Advantages for Students	Roles of Teachers
<ul style="list-style-type: none"> • Longer lasting ability to resurrect knowledge 	<ul style="list-style-type: none"> • Recognize the role of constructivism for the educational process
<ul style="list-style-type: none"> • Grasp concepts better 	<ul style="list-style-type: none"> • Act as a guide and facilitator
<ul style="list-style-type: none"> • Enjoyable and interesting education 	<ul style="list-style-type: none"> • Create realistic hope by recognizing important values
<ul style="list-style-type: none"> • Think independently 	<ul style="list-style-type: none"> • Information sharing at a professional level on the development of ESD

Table 3-1 Constructivism, advantages for students and roles of teachers

Source: Scoullos & Malotidi (2004)

The underlying Figure 3-3 describes the different steps that are undertaken by students when taking part in the SvD project. The red lined box indicates the focus of this thesis:

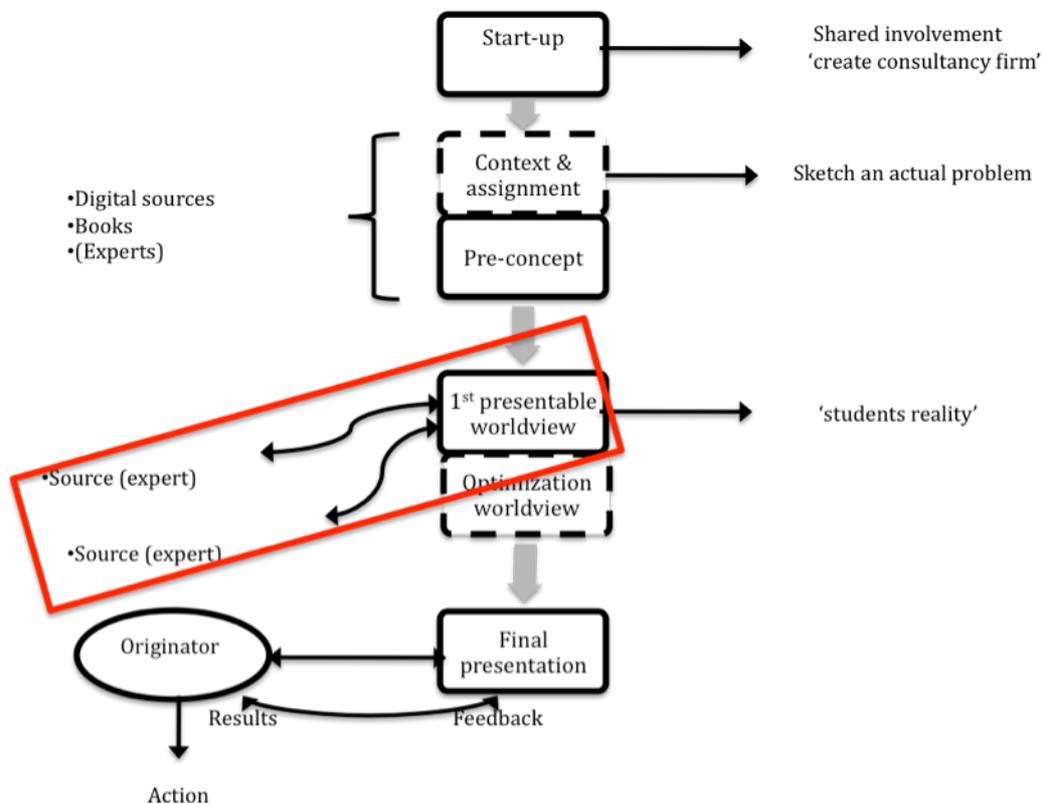


Figure 3-3 Steps within the SvD project

Source: D. Teeling, personal communication, June 9, 2009

The following main steps are of importance for the project; they are briefly discussed below:

1. Start-up, context & assignment;
2. Pre-concept;
3. First presentable worldview and optimization;
4. Final presentation.

Start-up, context & assignment

The project works with different themes that can be connected to the province in which the project is held. In South Holland, climate & energy is a broad theme (Van der Waal en Wals, 2009). The project is introduced to the students through the use of the storyline approach. The main feature of this method is that this educational approach recognizes and uses the already existing knowledge within students themselves. The storyline in this approach is the main 'read thread'. The content can be included in this story. Connecting content will eventually create the possibility to put students on a certain track (L. Blok, personal communication, August 31, 2009). An actual problem is sketched through either the use of a prominent person (e.g. the mayor) who assigns the students with a problem that needs solving or by introducing key questions within a story.

Pre-concept

Students, in this second step, start working on the problem or key questions that have been handed to them. They use resources such as books and/or digital sources to define what exactly it is that they are dealing with and to brainstorm on innovative solutions. Within the storyline method visualization, through the use of e.g. collages and pictures, plays an important role (Storyline Scotland, 2009).

First presentable worldview and optimization

The first presentable worldview, which results from the brainstorm sessions held by the students, reflects the students' view of reality of the topic. In order to optimize this first presentable worldview, students are encouraged to contact experts and are therefore provided with the 'Bronnenboekje', which is a booklet consisting of different experts cooperating with the SvD project.

Experts, according to IVN, can be classified into two major categories. The first category consists of persons who are employed by a government or company. The second category consists of persons who are working within a specific field of activity and possess a lot of specific knowledge about a certain topic (e.g. water). This second category of persons should be considered to be more like specialists. No distinction is made on basis of the source of experts' knowledge (e.g. scientific or practical). Experts that are cooperating in the project are expected to take students seriously and vice versa (L. Blok, personal communication, August 31, 2009).

IVN believes that the contribution of experts to the project has the advantages that students will:

- Gain more specialized knowledge (D. Teeling, personal communication, June 9, 2009);
- Get in touch with real societal issues;
- Understand the complexity of certain relations and society;
- Learn how to cooperate with different disciplines (L. Blok, personal communication, August 31, 2009).

Final presentation

Once the students have adjusted their concepts based upon the remarks and inputs of the experts, they can present their ideas. The original initiators of the different projects will get the chance to provide feedback to the proposed solutions and results of the students. These solutions and results are then transformed into an action plan that can be used by the different organizations to realize change.

4 LITERATURE REVIEW

This chapter was prepared to obtain answers for the main research question of this thesis, which is:

“How can ICT approaches support the integration of experts’ knowledge into high-school sustainability (-ESD-) projects of NGOs?”

The order of content of this chapter is based upon sub questions 1, 3 and 4 (see section 1.2 ‘Research Question’). First, the goal of ESD is described and educational efforts in order to integrate ESD into schools are discussed. Secondly, the different types of knowledge that experts possess are examined and, lastly, the supportive roles of ICT-tools are described.

This chapter will end with the creation of a conceptual model that allows the author to define and create more specific questions for the empirical data gathering.

4.1 The Concept of ESD

Where many organizations have tried to capture the essence of ESD in a definition, none of them have managed to create one that is universally applied. UNESCO’s definition, however, can be regarded to be the most important because this organization is the main promoter of ESD and furthermore, it operates on an international level.

According to UNESCO, the vision of education for sustainable development is ‘a world where everyone has the opportunity to benefit from education and learn the values, behaviour and lifestyles required for a sustainable future and for positive societal transformation’ (UNESCO, 2005a). UNESCO further emphasizes that decisions should be made in the light of such a sustainable future, while not forgetting the three pillars (economy, environment and society) of sustainability.

ESD approaches:

- Are locally relevant and culturally appropriate
- Are based on local needs while recognizing their global effects
- Engage several types of education (e.g. formal and informal)
- Promote life-long learning
- Recognize the evolving concept of sustainability and its 3 pillars
- Address content, context and pedagogy
- Take into account regional differences (UNESCO, 2005b).

Formal education has to be, depending upon circumstances of the educational system within a country, ‘reoriented’, in order to fulfill the requirements of ESD. This should happen at curricula, practices and policy levels. Reorientation of a curriculum should focus on several elements (UNESCO, 2005b). Figure 4-1 lists these elements and their expected outcomes:

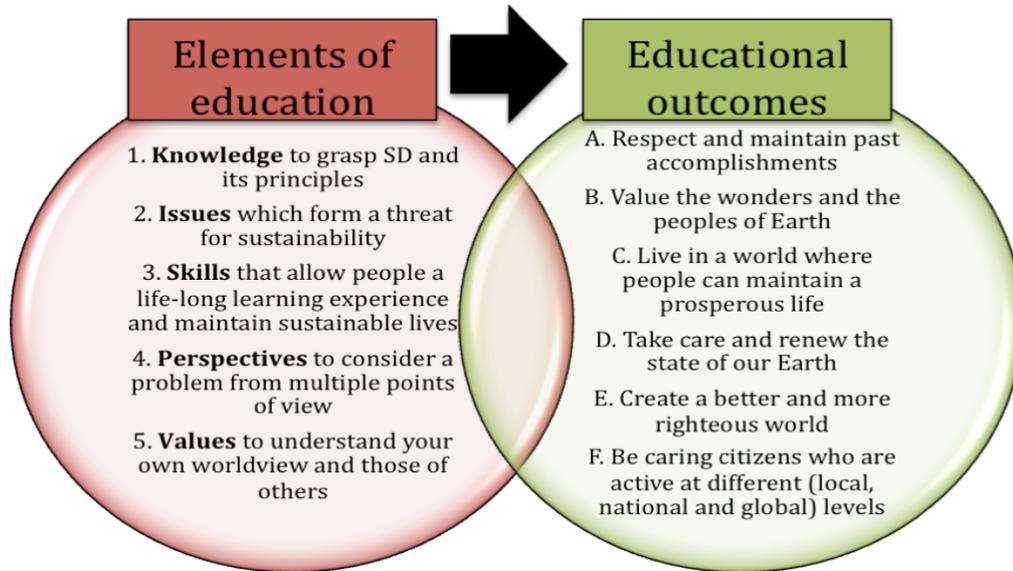


Figure 4-1 Elements of education and educational outcomes

Source: 'Training Guideline' (n.d.) and own interpretation author

With respect to the educational outcomes, two main distinctions that have been made within the literature are the differences between changes in attitude and changes in behavior. Dobson (2007) describes the 'voluntarist' approach, which believes that changing attitude will finally lead to structural changes in behavior. A lot of public policy discussions are also pointing in this direction and this approach can therefore be regarded to be of importance. Environmental approaches also attach value to such changes in attitude and behavior and some of them envision the inclusion of experts in the educational process. A few of these approaches are described here.

The first approach is the Environmental Legacy Education Program, developed in the United States of America (USA), which builds a bridge between the past and the present by introducing students to the historic culture of their region and linking this to the relevance of an environmental quality for this area (Flint, McCarter, & Bonniwell, 2000). The program uses knowledge from different high school courses (such as math, science, language, literature and history) to complete the team task, which consists of students building their own boats allowing them to examine the marine environment and its historic culture. During these boat trips, students learn about the ecosystems and threats to their survival, which makes the experience much more in line with their real life-experiences. Different participants of the community, such as conservationists or marine biologists, are also included in the teaching process. According to Flint et al., students will become self-confident decision makers and environmentally literate citizens, who are capable of interdisciplinary thinking, know how natural systems work and have the knowledge to understand linkages among living things. This approach allows students to undertake individual and joint efforts towards a sustainable future (Flint et al., 2000).

A second approach that was identified in literature is based upon experiential learning, which is learning by doing. Several experiential techniques are used in the program on 'International Environment and Development' at the American University located in Washington, DC. The four different aspects of this program includes of 1) a seminar, 2) an abroad practicum, 3) an internship and 4) an applied project. Students go on overseas trips and meet with scientists

and local communities. This allows them to link theory and practice and to understand the bigger issues through local circumstances. Meetings with individuals can make the students see that anyone, from one person to a whole organization, can make a change. This also empowers students to see the changes they can make in their own lives (Domask, 2007).

Another approach used in high schools and which was already introduced in section 3.3 of this thesis ('Start-up, Context & Assignment'), is the storyline approach. The storyline approach can be part of the strategy to introduce ESD into the classroom. Such an approach can be combined with the involvement of experts taking part in the educational process.

4.2 Experts

Scoullos & Malotidi (2004) also emphasize the involvement of experts in ESD. Scholars have further mentioned that such involvement provides:

- Opportunities for knowledge creation (Paavola & Hakkarainen, 2005);
- More interesting education;
- Practical input (Baars, Wieland, Van de Ven, & Jager, 2006).

Scholars have indicated that experts can influence the educational process. This has to do with the differences between novices (in this case: high school students) and experts. Edelson & Gordin (1998) use the following example to illustrate these differences. A scientist and high school student both want to learn more about global warming. Research questions related to this topic will, from the scientist's point of view, be based upon a deep understanding of different processes and data that might help him. Anxiety over the future and the need to fulfill course requirements probably motivate the student to ask his question.

This results in Edelson & Gordin (1998) differentiating between the elements of goals, activities and background knowledge, as is shown in Table 4-1:

	Experts	Novices
Goals	Create new knowledge or create new instrumental techniques; expressed in terms of tools and resources	Academic achievement and curiosity about the world; expressed in terms of tasks and knowledge
Activities	Structured by research community and funding sources	Structured by school assignments and personal interests
Background Knowledge	Mastery of fundamental principles and significant experience in practice	Sketchy knowledge of elementary science

Table 4-1 The differences between experts and novices in learning processes

Source: Edelson & Gordin (1998)

Much has been written about the last aspect mentioned in Table 4-1, background knowledge. Davenport and Prusak (2000) distinguish knowledge from data and information and give a working definition of the concept. Knowledge, according to them, is 'a fluid mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers.'

Several classifications of knowledge were obtained from the literature but one that is very commonly used seems to be the differentiation between tacit and explicit knowledge. Tacit knowledge resides within the knower, it is context-specific and is hard to formalize and communicate. Explicit knowledge, on the other hand, is simple, teachable and easier to ‘capture’ (Davenport & Prusak, 2000 and Nonaka & Takeuchi, 1995). Nonaka & Takeuchi (1995) describe the knowledge conversion process, which happens on the basis of social interaction between individuals and consist of the four different modes of socialization, externalization, combination and internalization (hereafter: SECI-process). The central focus is upon explaining how a knowledge-creation spiral can be formed from the interaction between tacit and explicit knowledge, also depicted in Figure 4-2:

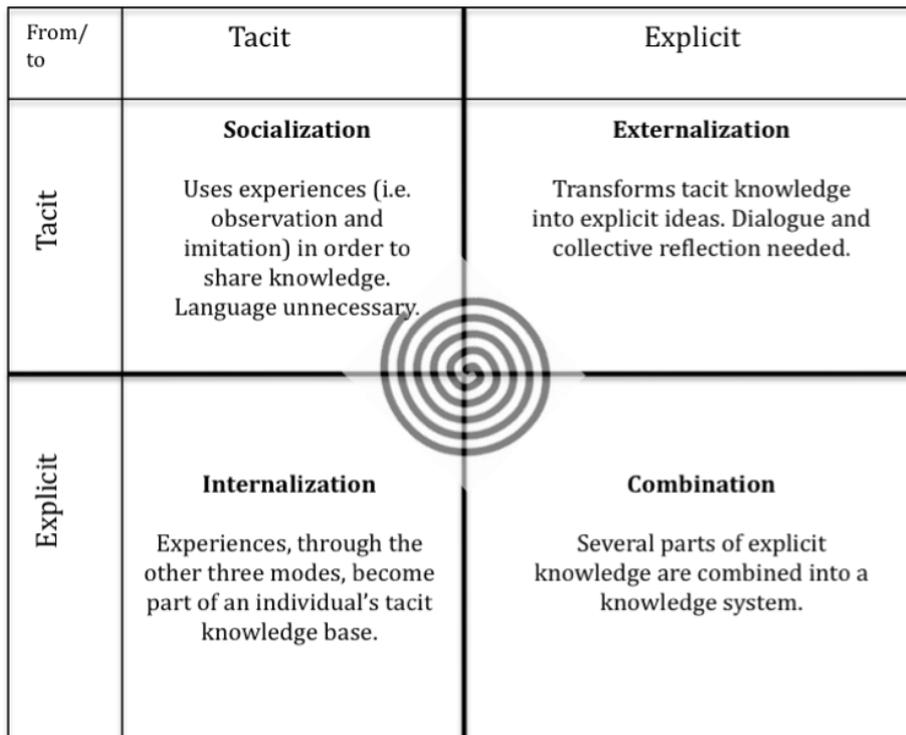


Figure 4-2 Knowledge conversion in the SECI-process

Source: Nonaka & Takeuchi (1995), Backhaus, Sattari, Hees & Henning (2006)

Socialization (tacit to tacit) is about sharing experiences. Apprentices observe and imitate their masters. Associated emotions and specific context play important roles in this mode. *Externalization* (tacit to explicit) is a process that transforms tacit knowledge into explicit knowledge. Writing is an act of externalization because tacit knowledge is changed into articulable knowledge. However, Nonaka & Takeuchi indicate that this is not enough to correctly represent the tacit knowledge. Therefore, this mode needs metaphor, analogy and model to express tacit knowledge. Dialogue and reflection are important factors in this mode because they trigger externalization. In the mode of *combination* (explicit to explicit), databases and documents combine several parts of explicit knowledge. *Internalization* (explicit to tacit), finally, resembles ‘learning-by-doing’. In this mode, the individual internalizes explicit knowledge, often with the help of spoken or written texts (Nonaka & Takeuchi, 1995).

According to Nonaka & Takeuchi (1995), tacit knowledge is hard to share because such knowledge is mainly obtained through experiences and is difficult to articulate. It is therefore

important to, within an organization, create a 'field', which enables face-to-face contact between individuals of different divisions and allows them to share emotions, mental models and body rhythm. The outcome to this process, a shared 'mental model' can then, through externalization, be transformed into an explicit concept. This process, passing through different stages that resemble the different modes of the SECI-process, creates new knowledge that leads to innovative processes within an organization (Nonaka & Takeuchi, 1995).

It is obvious that experts possess a form of knowledge, tacit knowledge, which will not be converted into explicit knowledge that easily. The following section 4.3 addresses ways that ICT can be of support when external knowledge is integrated into the teaching process.

4.3 ICT-tools & Experts' Knowledge

The term ICT can be applied to information handling taking place in an electronic manner, where the 'C' in this abbreviation illustrates the communication part. ICT includes hardware such as PCs and telephones and software to run these devices (Arnfolk, 2002). Technology, nowadays, does not contain many surprises for the youth. Terms such as the 'Net Generation' and 'Homo Zappiens' have been developed in order to indicate the different ways ICT is being perceived by the youth in contrast with the perception by older generations. It is therefore important to examine the different ways in which ICT should be involved in the educational process. Teachers should also receive and take part in technology courses, otherwise wrong decisions could be made when different technologies are chosen and the potential advantages of using ICT for students may be disregarded (Hentea, Shea, & Pennington, 2003). The constructivist approach, which has been described in section 3.3, also supports the integration of ICT into learning processes (see for example Eneroth, 2000 and De Vries, Van der Meij, & Lazonder, 2008).

Bataineh & Tubaishat (2009) define ICT-tools as tools that allow communication and cooperation of resources between persons. Eneroth distinguishes between different types of ICT-tools that are Web based and can offer several supportive functions, such as communication and E-learning (Eneroth, 2000). Tools can include Internet, e-mail, Windows Live Messenger (MSN) and Teleconference, Internet Explorer and Blackboard (Eneroth, 2000 and own interpretation author). However, different authors have further distinguished a whole range of available ICT-based possibilities that can have a positive impact on the educational process. Table 4-2 lists several of them and some of their advantages:

ICT-based possibilities	Advantage
Multiple-choice quiz	Allows the teacher to test knowledge of students (Dorrian & Wache, 2009)
Digital library	Connects students with resources (Marshall, Chen, Shen, & Fox, 2006)
Concept mapping	Allows the representation of knowledge (Marshall et al., 2006)
Games	Encourages a student's learning initiative (Fu, Su, & Yu, 2009)
Podcasts	Students can review course contents and educational institutions (Malan, 2007)
Wiki	Enables collaborative editing of content (Anderson, 2006).
Weblogs/reflective diaries	Allow self-reflection (García and Roblin, 2008).
Illuminate	Makes real time audio graphics possible (Anderson, 2006)

Table 4-2 A range of ICT-based possibilities offering educational support

ICT can replace classroom teaching completely, or a mix of classroom teaching and ICT can be used in order to provide students with educational opportunities. Such a mix is called

blended or hybrid learning and would ideally integrate the positive aspects of face-to-face teaching and distance education (Hentea et al., 2003). Communication skills of teachers and user friendliness of the technology have been identified as important factors that lead to positive results in blended learning, such as:

- Deeper learning;
- More interaction;
- Fulfillment of wishes and expectations;
- Better learning outcomes (Hentea et al., 2003); and
- Development of skills (Hansen, 2008).

Literature has also focused upon the capacity and limitations that ICT-tools possess in order to disseminate tacit knowledge that experts may have. Several studies have documented that ICT can help in the codification and sharing of explicit knowledge whereas direct contacts and communities of practice facilitate the transmission of tacit knowledge (Vaccaro, Veloso, & Brusoni, 2009). However, it is also reported in the literature that rich media can help with the knowledge dissemination of tacit knowledge between individuals, when these tools allow the communication of aspects such as intuition and learning-by-doing (Griffith, Sawyer, & Neale, 2003). Mohamed (2007) supports this view. He reports that new technologies, such as videoconferencing, make it possible to add gestures and movements to the context and a portion of the existing tacit knowledge can be expressed this way. An e-mail or telephone conversation cannot achieve this result (Mohamed, 2007).

Backhaus et al. (2006) have looked into a method that integrates tacit knowledge into the educational process through the use of ICT. This research focuses upon externalizing experts' knowledge through the use of the storytelling method in interviews. This method allows the exchange of complicated messages. The retrieved information will then be edited and stored in different types of media files. The storytelling method does not only allow the representation of tacit knowledge, according to Backhaus et al., but is also a good dialogue starter between students and teachers.

More direct ways of communicating with experts have been identified by Baars et al. (2006). Options that could be considered for this are videoconferencing, chat, e-mail or a discussion forum. Advantages of such involvement through distance education could be that:

- An expert cannot be present because of time and/or distance constraints;
- Communication between students and experts needs to be recorded in order to read it later (Baars et al., 2006); and
- There is a need for the contribution of experts involved in specific fields of expertise (Wolff, Deinum, & Wieland, 2002).

The following issues are of importance when an expert is involved through ICT:

- Discussion on content, plan and learning of the course and the task of the expert;
- Introduction of the expert and session to the students;
- Preparation of students before the start of the session;
- Thank the expert for his cooperation;
- Show results to the expert (Baars et al., 2006).

The four identified ICT-tools will now be described in more detail and the several advantages and disadvantages will be identified.

Videoconferencing

Videoconferencing enables synchronous learning, which takes place in the same time but at different places (Eneroth, 2000). Participating parties can see and hear each other during the session (Leonard, Riley, & Staman, 2003). Advantages of videoconferencing for the educational process are that videoconferencing:

- Reduces travel;
- Supports learning that happens 'real time' (Reynolds, Eaton, & Mason, 2008);
- Saves time (Collis, Peters, & Pals, 2001).

Disadvantages could be that, because videoconferencing takes place real time, images and/or speech could become blurred (Reynolds et al., 2008).

Chat

An online chat room offers the possibility to have synchronous learning. Several ICT-tools that offer chat functions also allow students to have face-to-face discussions. According to Hansen (2008) and Wolz & Palme (1997), advantages of chat rooms are that students:

- Express what they mean more easily because they can stay anonymous;
- Together have control for their learning; and
- Have the possibility to invite external persons.

However, the possible barrier to such an approach is that some individuals cannot keep up with the several threads that are created within one discussion (Wolz & Palme, 1997).

E-mail

A tool such as e-mail facilitates asynchronous learning opportunities; this means that learners may access the materials at different times and places (Eneroth, 2000). This in contrast with synchronous learning in which case all participants must be engaged at the same time. Advantages of e-mail are that it:

- Can offer interaction with others which can take place at any time without having to be in the same place;
- Can eliminate the need for physical meetings;
- Can be used to cover long distances;
- Allows shy students to more easily express themselves through the use of e-mail; and
- Allows students time to think about what they want to express (Wolz & Palme, 1997).

A disadvantage of e-mail can be that it can work distractive when incoming e-mail is announced through an e-mail program (Wolz & Palme, 1997).

Discussion forum

An online discussion forum offers asynchronous learning. Dorrian & Wache (2009) have identified the following advantages to the use of a discussion forum. Students:

- Feel more support;
- Can discuss course concepts; and
- Are able to help each other.

Possible barriers, with respect to discussions covering more the procedures than content and etiquette, have also been identified. Ways to solve these issues are to provide more guidance and structure in the discussion and to fulfill expectations of students and teachers concerning conduct (Dorrian & Wache, 2009).

This literature review of several ICT-tools helped this thesis author to develop the contents of Table 4-3. This Table sums up the pros and cons of different ICT-tools that have been discussed. The last column was adapted from Wolff et al. (2002) and shows the way that experts can be involved through the use of different ICT-tools in the educational process.

ICT-tool	Pros	Cons	Contribution of expert
Videoconferencing	<ul style="list-style-type: none"> • Reduces travel • Learning happens ‘real time’ • Time savings 	<ul style="list-style-type: none"> • Images and/or speech could become blurred 	<ul style="list-style-type: none"> • The specific time/location can be booked on forehand • Students can react to the story of the expert • Students can ask questions and have a discussion with the expert • The expert can also show things during the presentation
Chat	Students: <ul style="list-style-type: none"> • More easily express themselves • Together share responsibility for learning 	Students: <ul style="list-style-type: none"> • Cannot keep up with the main threads created within 1 discussion 	<ul style="list-style-type: none"> • Involvement will cost a specific amount of time • The specific time/location can be scheduled on forehand • It is easy to set up • The discussion can be documented
E-mail	<ul style="list-style-type: none"> • Can offer interaction with others which can take place at any time without having to be in the same place • Can eliminate the need for physical meetings • Can be used to cover long distances • Allows shy students to more easily express themselves through the use of e-mail • Allows students time to think about what they want to express 	<ul style="list-style-type: none"> • Could work distractive 	<ul style="list-style-type: none"> • Experts can be on ‘standby’ to answer questions to students • The expert can decide for him/herself when he/she wants to answer a question • E-mail could be a tool with which the expert him/herself is more familiar than with other ICT-tools
Discussion forum	Students: <ul style="list-style-type: none"> • Feel more support • Can discuss course concepts • Are able to help one another 	<ul style="list-style-type: none"> • Discussions cover procedures in stead of content • Netiquette 	<ul style="list-style-type: none"> • Involvement in the online discussion and decide when he/she wants to deliver input

Table 4-3 ICT-tools: pros, cons and contribution of experts

4.4 Summary

UNESCO emphasizes the importance of ESD for a world that can offer enough opportunities for a sustainable future. In order to reach this, UNESCO emphasizes the importance of the reorientation of formal education, schools and their policies towards ESD. It is thereby important that several identified elements of ESD are kept in mind in order to achieve the desired educational outcomes. Throughout the world, many approaches to ESD

have been developed. The literature review covered some of them, which included the involvement of experts and the important contributions they can offer to the teaching process. From one single expert to a whole community including a range of experts, it is recognized that such contributions can have positive effects to the educational process. It enables students to make conscious decisions about a sustainable future and also see the possible changes they could make in their own lives.

When experts are actively involved in such approaches, it is important to recognize the different types of knowledge they possess. Especially the differences between experts and novices (in this case: high school students) can be large. Experts possess a lot more tacit knowledge than students. Such knowledge is hard to share with others. Explicit knowledge, on the other hand, is easier to share. The conversion of tacit to explicit knowledge takes place through the SECI-process. In order to convert tacit into explicit knowledge, a 'field' will have to be created which allows face-to-face contact of individuals. This way, individuals can share mental models and body language, finally allowing tacit knowledge to be converted into explicit concepts.

The literature provided the thesis author insights in the supportive role of ICT-tools with the integration of experts' knowledge into the educational process. Even though scholars acknowledge that some ICT-tools are becoming more and more suitable to support the expressions of portions of tacit knowledge, it remains unclear exactly how far these possibilities actually reach. What did become clear from the literature review, however, is that ICT-tools that allow the communication of body language, intuition and learning-by-doing have more added value in this respect.

A method, which uses externalization to integrate experts' knowledge, has been examined. Several ICT-tools, which allow more direct communication links, have also been identified (videoconferencing, chat, e-mail and discussion forum). The advantages that these tools have for the educational process and the contributions that experts can deliver through the support of these tools were summarized in the literature review (see also Table 4-3 under section 4.3 'ICT-tools & Experts' Knowledge').

4.5 Conceptual Model

The above-described analysis allowed the thesis author to create the following conceptual model that is represented in Figure 4-3:

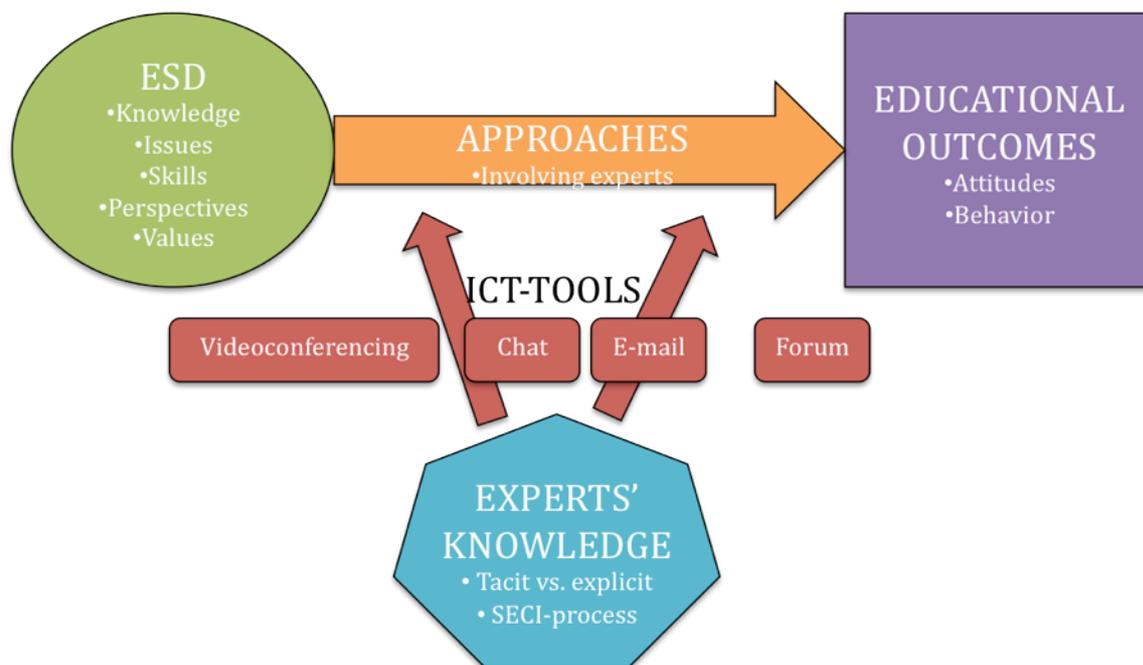


Figure 4-3 Conceptual model

A closer analysis of the model:

ESD approaches should take into consideration knowledge, issues, skills, perspectives and values (this is indicated in the green ball). The expected outcomes of these approaches can be classified into two main categories, changes in attitudes and changes in behavior, where attitude change leads towards behavioral change (indicated in the purple square). In order to reach these changes, a whole range of ESD approaches have been developed. Several of these ESD approaches involve the contribution of experts (indicated in the orange arrow).

ICT can help with the integration of experts' knowledge into the educational process. Hereby should be kept in mind that experts possess different kinds of knowledge and the way their knowledge is converted into more explicit concepts through the SECI-process (indicated in the blue heptagon). Identified ICT-tools include videoconferencing, chat, e-mail and the use of a forum (indicated by the red arrows and cubicles).

4.6 Propositions and Empirical Research

The main research question and its sub questions have been preliminary answered through the literature review. However, the conceptual model raises new questions about how the contributions of experts are perceived to be useful within the teaching and learning process, how students use ICT-tools to assist them to get in contact with these experts and how students learn from them.

The following propositions can therefore be derived from this conceptual model:

P1: *The contribution of experts in the teaching process is useful and leads to desired educational outcomes.*

P2: *The identified ICT-tools (videoconferencing, chat, e-mail and forum) are used on a regular basis within the educational process.*

P3: *Experts can contribute to the educational process in a constructive and positive manner with the support of ICT-tools. However, some difficulties could be expected because of the differences between experts and students and the capacities of ICT-tools to deal with these differences.*

Besides this, some time will be spent on investigating whether students prefer to be taught by a teacher through traditional classroom teaching or feel that ICT could replace the role of the teacher.

5 HIGH SCHOOLS

Chapter 5 introduces the reader to the different case studies that have been conducted during the research of this thesis.

The case studies were done in two Dutch high schools, the 'Driestar College' in Gouda and the 'Libanon Lyceum' in Rotterdam. An interview with an expert who participated in the SvD project was also held. Bottlenecks and improvements, within the implementation and execution of the project, were documented and are explained to the reader through the description of the case studies and the experiences of the expert.

5.1 The Driestar College

Characteristics of the school

The Driestar College is a Christian school and provides secondary education to students at different levels. The school's buildings are located in three Dutch cities; Leiden, Lekkerkerk and Gouda. The location visited by the thesis author was at the school in Gouda; it has approximately 3100 students.

Content of the project

The school was running another project before switching to the SvD project. The students taking part in the school year 2008-2009 focused on the European Union Water Framework Directive, which deals with the water quality within the European Member States. Students were asked to advise the District Water Control Boards of Rijnland and Schieland on how to make the pumping stations and the accompanying water channels 'fish friendly'. In order to answer this question, students had to perform a literature review, undertake field trips and carry out calculations. Students also had to attend pre-arranged workshops at school in which experts participated. Groups of different students were formed and received approximately 20 hours to work on the project during a one-week time period.

Participation

The author interviewed four students (two boys of 14 and 15 and two girls of 15) and one teacher of the Driestar College. Two of the students were at Lyceum level and two of them at 'HAVO' (higher general continued education) level.

The names of the students that were interviewed are presented in the Appendix of this thesis (see Table 11-1) but are not specifically mentioned here. Students were asked about the approach of the project, PC-use at home and school and the outcomes of the project on their personal lives. This gave the following results as indicated in Table 5-1:

Students &....	The project's approach	PC-use at home	PC-use at school	Outcomes
	<p>The project's approach is considered to be positive, because it offers:</p> <ul style="list-style-type: none"> • More content depth • Possibilities to learn how to co-operate • A more sociable way of interacting 	<p>Ranging from 1 hour (weekday) to 5 hours (weekend). Students:</p> <ul style="list-style-type: none"> • Play games • Do homework • Check e-mail • Use Hyves • Chat with others • Surf the Internet • Watch movies on YouTube • Listen to music 	<p>Ranging from 1-2 hours per week to 1-2 times per month. Students perform:</p> <ul style="list-style-type: none"> • Schoolwork and assignments • Examinations for specific courses 	<p>Mixed. Students:</p> <ul style="list-style-type: none"> • Recognize that the project focuses upon environmental issues and thinking of creative solutions; but • Indicate that they did not change their own behavior because of participation.

Table 5-1 Students Driestar College &... the project's approach, PC-use and outcomes

Martin van der Grond educates Dutch as a course at the Driestar College and has been employed by this school for seven years. He was asked by the school to run, together with some of his colleagues, the project of SvD; he had a guiding role towards students and teachers during the project week.

Van der Grond is enthusiastic about the project. Aspects can be covered through the project that would not be part of the normal courses. The students had to, for example, carry out calculations and perform water measurements. As a result, the chemistry teacher then can devote his lesson to this aspect. This way, several teachers can contribute from their own fields of expertise. The overall consideration of Van der Grond towards the project is positive (M. Van der Grond, personal communication, June 18, 2009).

However, some drawbacks were also expressed which can be linked to organizational issues within the school. Mainly organizationally it is difficult to 'fit' the project 'in'. New organizational structures will have to be created. This has mainly to do with, the sometimes poor, communication within the project team. Another point, which could be made here, is the fact that teachers went with students on field trips, leaving the guidance of students who stayed at school to volunteers. This has implications for the way ICT is used during the project, according to Van der Grond (M. van der Grond, personal communication, June 18, 2009).

ICT-tools and experts

The school incorporated experts' knowledge in several ways. Students went on fieldtrips where they could meet with experts, workshops taught by experts were organized and students could use computers in order to contact experts. Since the school has a PC room, which students can use for the project, they can be in contact with the experts.

When the students were asked about their experiences in contacting experts through ICT, they provided mixed responses. First of all, none of the interviewed students contacted the experts themselves but their group members did this. Two students mentioned the positive aspects of such contact with the expert, because of his/her expertise, provided valuable information for

the project and report. The expert's inputs were actually used within the final report. Furthermore, one of these two students mentioned that the use of e-mail was convenient because the information was written down and could be read again. The expert that was contacted by her group answered quickly and accurately.

Another student's group had not e-mailed at all with an expert. The reason for this was the fact that his group decided that the quality of the report was good enough in itself and the group was unsure whether any expert could strengthen its quality. One of the other students mentioned that her group had e-mailed to an expert but they never received a reply. According to her, a disadvantage of e-mail is the fact that you may not get a direct answer to your question. She also wonders whether the experts cooperating in the project knew that they could be contacted.

According to Van der Grond, the contributions that experts can deliver in the classroom are positive because they all have their own fields of expertise. As a teacher, you will also get your information from different people who are knowledgeable about certain topics. Furthermore, students automatically accept that experts can teach and tell them more about certain issues, which they may not be able to learn from their teachers because it is not their specialty (M. van der Grond, personal communication, June 18, 2009).

The role of the expert in this is that students can ask questions about issues that they have trouble with. However students, within this project, have not gone this far because of several reasons, such as the guidance that was provided by the school and the learning level of the student. And it is also this guidance that is of importance when ICT is used in education, because teachers will have to be on top of things in order to achieve this. In Van der Grond's eyes, real-time communication, through the use of e.g. MSN and Skype, would make good contributions to the educational process when students contact experts. However, Van der Grond also believes that this is not very feasible, because for these experts it is just something that they do besides their regular jobs; they have agreed to cooperate on the project on a voluntarily basis (M. van der Grond, personal communication, June 18, 2009).

5.2 The Libanon Lyceum

Characteristics of the school

The Libanon Lyceum is located in Rotterdam; it consists of two buildings and offers different levels of teaching to students. The buildings each accommodate 600 students each. The school offers two main educational streams: traditional teaching and adaptive teaching.

Content of the project

The theme that students of the Libanon Lyceum during the year 2008–2009 worked on was making the Rotterdam harbor more sustainable. Students and their groups were then given the opportunity to brainstorm on different topics related to this theme. Two topics that were chosen focused on the areas of logistics and chemistry. Students made an excursion through the Rotterdam harbor and an expert of the Port Authority visited the school. Groups of different students were formed and received approximately 30 hours to work on the project spread over 10 lessons.

Participation

The author interviewed three students (two boys of 17 and one boy of 16) and the rector of the Libanon Lyceum. The students were all at ‘VWO’ (pre-university secondary education) level. The names of the students that were interviewed at this school are listed in the Appendix of this thesis (see Table 11-1) but are not specifically mentioned here. Students were asked about the approach of the project, PC-use at home and school and the outcomes of the project on their personal lives. This gave the following results as indicated in Table 5-2:

Students &...	The project's approach	PC-use at home	PC-use at school	Outcomes
	<p>The approach of the project is considered positive, because it offers:</p> <ul style="list-style-type: none"> • Applied and active involvement • Seeing how far you dare to dream • Learn from each other and learn unaware • More content depth • Possibilities to learn how to cooperate • A more sociable way of interacting with other students • Independence • Contribute to society and science 	<p>Ranging from ¾ hour to 4 hours (weekday).</p> <ul style="list-style-type: none"> • Play games • Do homework • Check e-mail • Use Hyves • Chat with others • Surf the Internet • Listen to music • Watch movies 	<p>Ranging from 10 minutes to 4 hours a week:</p> <ul style="list-style-type: none"> • Schoolwork and assignments for different courses 	<p>Mixed. Students:</p> <ul style="list-style-type: none"> • Recognize that the project focuses upon environmental issues and thinking of creative solutions; but • Indicate that they did not change their own behavior because of participation.

Table 5-2 Students Libanon Lyceum &... the project's approach, PC-use and outcomes

An interview was held with the rector of the Libanon Lyceum, Paul Scharff, who has been working for the school for six years. In his job, Scharff is responsible for everything connected to the school; from educational materials to anything having to do with the management (Headmaster and Deputy Heads) of the school. The school does not have a specific ESD strategy, which is being integrated into the courses and/or the school policy.

The Libanon Lyceum got involved in the SvD project because the school realized that a connection between the traditional school courses was needed. Preconditions for any project to be adopted by the school, were that such a project showed this connection, was relevant concerning content and shows children that they can deliver a meaningful contribution to the world. Additionally, Scharff was very happy with the fact that the teacher running the project is also concerned with sustainability issues herself. It is important that teachers are concerned about such issues because they are the ones who create inspiration, or don't (P. Scharff, personal communication, June 25, 2009).

Scharff, even when he acknowledges that he does not know enough about the SvD project to say too much about it, is positive about the project for several reasons. Students are enthusiastic about the project. Involvement, giving students choices and letting them do research lead up to this enthusiasm. The fact that students are so involved and can take initiative makes that the project becomes theirs. Scharff was also positive about the involvement of experts in the teaching process. He indicated that a ‘good’ expert should possess two qualities. He/she has a lot of knowledge about his/her own field of expertise and

he/she must possess qualities to create enthusiasm amongst students. This last aspect could be a problem sometimes (P. Scharff, personal communication, June 25, 2009).

The role of ICT within education goes at 'a snail's pace'. Fifteen years ago, everyone was very excited about the arrival of ICT. However, if teachers nowadays use a beamer and show an Internet movie, they feel that they are working in the most modern way. PCs and beamers are the most often used within the Libanon Lyceum. Scharff would say that this state of affairs is what on average is happening within secondary education in the Netherlands (P. Scharff, personal communication, June 25, 2009).

ICT-tools and experts

Students were asked about their experiences with contacting experts through the use of ICT. One student's group e-mailed with an expert in the USA after receiving his name from their teacher. They posed him a question about their project. The expert responded with a document containing a lot of specialized information and formulas on chemistry and pointed out which information he considered to be relevant for the students. Eventually, not a lot of the information that the document contained was useful to the students because it was above their level of knowledge but part of it could be used to support their project.

According to this student, the use of e-mail was handy because you cannot lose the e-mail and more people make use of e-mail, which makes this tool more accessible. This student also indicated that he did not expect an immediate answer from the person he is e-mailing. When it comes to improvements that could be made when communicating with experts, this student indicated that a more diverse range of experts that could be contacted would have been useful. Furthermore, he said that creation of a specific website, which would allow communication with all experts, would be good to have had during the project. Other students that took part in the interviews were asked what they thought of this idea and they all agreed that it would be useful for the project.

The other two students e-mailed an expert whose name they had found in the 'Bronnenboekje'. This person guided the students to a colleague of his who knew more about their specific topic. The students arranged a meeting with this expert. The students indicated that they understood what the expert was talking about. They mainly learned facts and some opinions from him. When these students asked the expert about the correctness of their idea, the expert indicated that he thought the idea would not be optimal qua efficiency. However, the students later received feedback during a presentation about their idea and another expert indicated that their idea did have potential. The students therefore indicated that they learned from contacting the expert that he/she can be wrong about his/her assumptions as well and that you should not always just assume everything.

These two students were asked whether, if they would only have been able to contact the expert through ICT-tools, they would find the outcomes just as satisfying as with having personal contact. However, one of the students answered to this question that he felt that personal contact is better, because you can really check whether a person is reliable and you can ask questions directly.

5.3 IVN-expert

An interview was held with an IVN volunteer who provided the SvD project with his expert advice, Arthur Hilgersom. Hilgersom has been a volunteer for the past nine years with IVN Delft. He is next to his volunteering activities also an architect in his professional career.

Hilgersom has not had contacts with students through the support of ICT-tools but he has helped once with the closing event of the SvD project in The Hague in 2008. Students had to present their presentations and he judged the students' work and questioned them. Hilgersom was very impressed by their presentations and the way high schools can give input on several topics and think of solutions. According to Hilgersom, students were working on an almost adult level and there was no need for him to adapt himself to a different, lower, level. Students could very well express themselves and explain what their motivation was. It is, in your role as an expert, also important to treat students as an equal discussion partner (A. Hilgersom, personal communication, September 4, 2009).

From his architect work, Hilgersom knows how an organization functions and has an 'all-round' view on how things are made and how expensive things are. Such knowledge comes from experience. If you can share such experiences, depends, according to Hilgersom, on the patience of someone who wants to apprehend it. You don't learn it from attending six years of high school but through for example your profession or working with different things. Hilgersom also wonders whether it is the goal of the SvD project to share the whole way of thinking he, as an expert, can possess. However, when it comes to sharing experiences, it is important to, in the role of an expert involved with the SvD project, learn students that they should ask questions about their living surroundings, the way things are arranged and how things can be improved. The role of the expert can be one of an 'eyes opener' (A. Hilgersom, personal communication, September 4, 2009).

Hilgersom believes that he could teach his attitude towards sustainable development through the use of ICT-tools, such as Skype, in a limited time of 30 minutes. It is thereby of importance that students realize that things can also happen in a different way and then start thinking of how these changes could be made. This could be accomplished through asking the students questions and providing them with examples. It also depends on the affinity a student is showing. When you know a person's affinity, you know in which direction you should guide him as an expert. This also has to do with the way a person communicates (A. Hilgersom, personal communication, September 4, 2009).

Hilgersom does not think that there will be a lot of differences between the several ICT-tools that can be used but that this is dependent upon a person's willingness to openness. When it comes to his preference for a certain ICT-tool, Hilgersom would prefer to use e-mail to contact students. E-mail allows Hilgersom to provide feedback at times that are convenient for him in his otherwise busy schedule, does not take up as much time as a face-to-face meeting (which involves traveling) and it allows the attachment of for example links to websites (A. Hilgersom, personal communication, September 4, 2009).

5.4 Other Researched Issues

Outcomes

Several of the interviewed students at both the schools were asked what the outcomes were of the project on their personal lives and whether they had changed their behavior because of their participation in the project. Students indicated that they realized that the issues they were working with contribute to environmental problems. However, because they themselves are

not confronted with the consequences of these problems since these problems are not interfering with their own lives, students did not see a need to adjust their behavior. Students were asked what kind of changes would have to happen in their personal lives in order for them to change their behavior. Financial measures, time consequences or being confronted with the problem themselves were issues mentioned by students that would make them change their behavior in a more environmental friendly way.

Preference of students: real vs. virtual contacts with teachers

Students were asked whether they would prefer the traditional teaching of a teacher in front of a classroom or ICT (in this case: a PC) would also suffice in this respect. Only one student indicated that he would prefer a combination of both. All the other students preferred education from a teacher and several reasons were mentioned. According to the students:

- When books are studied, the teacher will know what is in it in contrast to the Internet, which is pretty broad.
- A PC does not answer immediately, a teacher does. An answer on a PC does not just 'jump up'. A teacher is clearer.
- The teacher allows better concentration.
- A teacher is more personal and direct questions can be asked. With a computer, everything takes long.

Observations of thesis author

As already stated in Chapter 2 of this thesis, the thesis author went to the closing event of the SvD project in The Hague. Three presentations and a panel discussion with the whole group of students were witnessed. The presentations by students on different topics were remarkably clear and impressive. Students had really put a lot of time and effort into their projects. They could also express themselves in a clear manner and were able to answer the questions coming from peers and experts who were present. The students had managed to make the different topics 'their own'. During the panel discussion, questions were asked and students had to respond. From the answers, the author concluded that several of these students were very well able to join in the discussion and not afraid to give their opinion about several issues related to sustainability.

5.5 Summary

The interviewed persons who are professionally connected to the two visited high schools, thought that the contribution of experts would be valuable for the educational process. Experts can contribute to the project because they all have their own field of expertise and can create enthusiasm amongst students. Students, who had contacted experts, also found the feedback of experts important for their project work.

The interviewed IVN-expert feels that his contributions as an expert could be important to be able to make students question their living surroundings, the way things are arranged and how things can be improved. He also indicated that it is difficult, as an expert, to share experiences that come forth from for example his work. A student would not learn these experiences from his/her high school period. The role of the expert, when contacting students, could therefore be more one of an 'eyes opener'. It is thereby of importance that a student shows willingness to openness and affinity. E-mail was mentioned as the ICT-tool, which would allow him time savings and flexible use when participating in the project.

Three students and their project groups had e-mailed an expert and received a reply. One student's group had sent out an e-mail but did not receive a response and another student's group had not used the possibility to contact an expert at all. One student's group had used e-mail to contact the expert and arrange a face-to-face meeting. When the different students' groups did get a reply, this reply was seen as valuable to their project work and could be used. Only once was the provided information partially too complicated to use for the students.

6 ESD PROGRAMMES & ICT

This chapter will introduce the reader to several programmes in the Netherlands and Sweden that integrate or are planning to integrate experts' knowledge through the help of ICT.

The discussed programmes were selected through the use of the 'snowball method'. Their relevance for the thesis research was indicated by for example thesis supervisors.

6.1 The International Institute for Industrial Environmental Economics

The International Institute for Industrial Environmental Economics (IIIEE) has been raised in 1994 and is part of Lund University in Sweden. The IIIEE has two main focus areas; research and education. The first focus area concentrates on analyzing and developing strategies for dealing with sustainability challenges (International Institute for Industrial Environmental Economics [IIIEE], 2009). The other main focus, education, unfolds itself through several ways. The Institute, for example, offers several Master programmes which students can enroll in and hosts several distance education programmes that will be discussed now.

The Young Masters Programme

The Young Masters Programme (YMP) has been running since 1999; it engages 16 to 18 year old students from throughout the world in each year's Programme. The underlying objectives of the Programme are twofold:

- To educate the students on environmental and sustainability issues; and
- To introduce sustainability programs within high schools (McCormick et al., 2005).

The course consists of four parts. Parts 1 and 2, which are presented online, create the theoretical basis for discussing sustainability issues and their preventative environmental strategies (Sustainability – WHY? and HOW?, 18 modules in total). Part 3 brings this knowledge into action in project form. Part 4 is a gathering of YMP students and teachers that takes place once every two years during which projects and their outcomes are presented (Young Masters Programme [YMP], 2008).



Several issues, such as natural resources, their use, the concept of sustainable development and solutions, are dealt with throughout the Programme. 'Hanna', a virtual 17-year old girl, concerned with the environment, guides the student through these topics in a playful and comical manner. The texts used in the presentation are easy to follow and clear to understand. Students are introduced to 'learning activities' and a 'take action' part. The Programme, furthermore, offers the possibility to provide feedback to other students and teachers in forum discussions and to have real class meetings.

Figure 6-1 Hanna

Source: YMP (2008)

Four people in total, of whom two have been interviewed, run the Programme. Torvald Jacobsson is Director of the YMP and Paola Mendoza the Course Administrator.

Mendoza explained that the Programme has had participants from over 113 countries until now and provides a complementary course in the schools, which have been involved with the YMP. Schools and students usually find the Programme themselves and teachers can register for the course. Groups of three to five students are created and are then organized into different ‘virtual’ classrooms. Every group has to, after reading the learning activities, discuss and answer the learning activities that are connected to parts 1 and 2 of the Programme on especially therefore created YMP forums. The Programme also has created a teacher forum, where teachers can communicate with each other about the Programme, share questions or discuss topics (P. Mendoza, personal communication, May 6, 2009).

Mendoza started working for the Programme as a tutor, a function that she, up until a certain degree, still performs. A tutor’s job is to provide feedback on the submitted assignments. She sees a challenge here because every Batch consists of 380-500 groups of students. That is a very large number for the number of YMP tutors, which is only one or two. The forums have been created to tackle this challenge. Students and teachers taking part in such a forum can comment on each other’s assignments and share questions, reflections and ideas. The tutor can then decide which issues he/she wants to address. According to Mendoza, the YMP provides valuable thinking activities and the development of academic and team working skills (P. Mendoza, personal communication, May 6, 2009).

Jacobsson has been working for the YMP for three years now; he was already working on environmental issues in different fields before becoming Director of the Programme. He also worked as a filmmaker.

According to Jacobsson, the YMP tries to create a platform that could involve a very large number of students and teachers, which requires that distance education is ‘re-invented’. On top of offering the students and teachers a basis for discussion and learning in their own classroom, the YMP adds the possibility to create a ‘window to the world’, outside the students’ own schools and countries. Such a situation is hard to recreate in a normal, traditional classroom. The most insight-bringing and view-changing part of the learning process lies in the personal interactions that take place between and among people of different backgrounds and cultures. There you learn something about the implications of sustainability that you cannot learn from a textbook (T. Jacobsson, personal communication, May 6, 2009).

Jacobsson indicates that the complexity of sustainability does not lie in the general notions of the problems or challenges, but more in dealing with complex issues, conflicting ends and how to get people on board when you want to promote change. Therefore, it is not about tackling problems in theoretical terms but about understanding that there are many different solutions and the trick here is to understand how to get people to cooperate. The course content is a discussion starter to get students actively involved in their local communities, to perform research and to disseminate their findings in the virtual classroom. And then a discussion, which forms the most valuable part of the learning process, is started. The course does not see the computer as the main thing but as a tool to get people in touch with each other. In this way, the computer is the vehicle to get school classes in contact with the outside world (T. Jacobsson, personal communication, May 6, 2009).

The course, as it is arranged now, is very linear. The process of solving sustainability issues, however, is not. Such a process starts with a mission, challenge or conflict of interests and different resources – of which theoretical knowledge is one of many – are needed to solve the

problem in a sensible, supportive and sustainable way. Digging into a problem that gets more and more complex, investing things and finally finding ways to collaborate with others will show the students the big picture and also fosters creativity in seeking ways to address the problems involved. In order to achieve this, students should clearly understand what their 'mission' is and the objectives they should meet. ICT-tools can then help in offering a whole range of resources (e.g. knowledge bases, methods, interviews with researchers, background documents and the community of students and teachers providing feedback as key resources) that support this mission. The YMP does not feature these aspects right now but the international research community is present, which would allow such features to be implemented into the Programme (T. Jacobsson, personal communication, May 6, 2009).

It is not easy, according to Jacobsson, to integrate experts' knowledge into the educational process and this should not, in his view, be created through setting up real-time virtual sessions between students and experts. Instead, Jacobsson wants to include several persons from the international research network who will give an interview about their specific fields of work. Drawing upon his filmmaking experiences, it is thereby important to make the information collected from this interview as understandable as possible by asking the same question over and over again, which makes the answers easier to understand, and finally to edit the whole interview. Advantages of such an approach are that the student will:

- Feel that he/she is actually seeing and hearing the scientist;
- Understand that scientists look different, sound different and have different ways of presenting their findings;
- Feel inspired to maybe become a researcher him/herself (T. Jacobsson, personal communication, May 6, 2009).

Energy for Sustainable Development

The Energy for Sustainable Development (E4SD) online course focuses upon sustainable energy choices. Participants allowed into the course must have several years of work experience in relevant fields.



Figure 6-2 E4SD logo

Source: Energy for Sustainable Development [E4SD] (n.d.)

Participants learn about the link between energy and sustainable development and how different approaches with respect to services, management and use of energy can create such development. Topics that are covered during the course are sustainable energy choices, ways of implementation and policy requirements (E4SD, n.d.).

The course is delivered by the IIIIEE in collaboration with different partners. The course starts with an introductory part. These 'introductory modules' consist of a forum, glossary, terminology quiz and guidelines for assignments. The course is further divided into three different sections, 'Energy for Sustainable Development', 'Energy Resources and Technologies', and 'Enabling Frameworks and Policies for Sustainable Energy', which sections in their turn are divided into a total of 12 modules (including quizzes, readings and assignments).

Most of the knowledge gained by students in the course comes from online written resources, which are condensed versions of the "World Energy Assessment: Energy and the challenge of Sustainability". The course is taught through Internet and uses a web platform, forum and e-mail.

The two Coordinators of the E4SD course, Lars Strupeit and Katsiaryna Paulavets, were interviewed. Both jobs involve responsibilities for the coordination, development, evaluation and administration of the E4SD course.

The course, according to Strupeit, has had 200 participants from over 80 countries taking part in the programme and there are plans to scale it up. The course group is made up of diverse participants, coming from all over the world, with different backgrounds and experiences (L. Strupeit, personal communication, May 11, 2009). Paulavets mentions that the course creates a platform for course participants to exchange their knowledge and experiences within the energy and development field. Participants eagerly take part in the forum discussions (K. Paulavets, personal communication, May 11, 2009).

In these discussions, participants have to answer questions that are related to their own countries and provide feedback to two different assignments. All the answers in the forum are sent out to participants in the form of e-mails. Experts provide additional input to the course by stimulating the discussions in the forum and providing feedback on assignments. Experts are selected on their 'energy' skills. Participants all have experience in their specific area and are, through the course, provided with terminology basics and should therefore all be able to catch up quite well (L. Strupeit, personal communication, May 11, 2009).

The discussions in the forum are useful for the participants according to Paulavets, because it provides them with the insights on similarities and differences in their own and other countries and can therefore learn from each other. The probability that people would share wrong information with each other is hereby quite low because of peer review (L. Strupeit, personal communication, May 11, 2009). This has to do with the fact that the programme, when selecting participants, accepts people who have a school degree and the relevant knowledge from work experience. Ideally, the programme would like to accept people in that fulfill higher positions and can contribute to change (K. Paulavets, personal communication, May 11, 2009).

6.2 United Nations University & Regional Centre of Expertise Rhine-Meuse

The United Nations University (UNU) has been established in 1969 to perform research on pressing global issues, encourage scholarly cooperation and support research performed in the developing world. The four key roles of the UNU are to:

- Internationally form a community of academics;
- Connect the UN with the international academic world;
- Be a 'think-tank'; and
- Help with capacity building (United Nations University [UNU], 2009).

The UNU has been trying to promote Regional Centres of Expertise (RCEs); such Centres have been established across the world. While the UNU is more like a think tank, the focus of these Centres lies more on practical issues. Each one of them is implementing different environmental programmes. Local networks of institutions have been establishing these Centres since the start of the DESD. The youth is one of the target groups that these RCEs can have. The UNU also offers a network in order to bring the Centres together (B. Barrett, personal communication, August 12, 2009).

OPEDUCA

One of these centres, RCE Rhine-Meuse, is located in the Netherlands, Limburg. The 'Open Universiteit Nederland' (Open University Netherlands), the 'Hogeschool Zuyd' (Academy Zuyd) and the KidsLive! Foundation are founding partners of the RCE Rhine-Meuse, which runs the OPEDUCA project. The name OPEDUCA is derived from the term 'Open Educatieve Omgevingen' (Open Educational Surroundings) that is designed to develop 'physical and virtual educational surroundings within and between social demographic regions on different themes such as environment, ecology and entrepreneurship' (Eussen, 2009).

The aim of OPEDUCA is to motivate people to learn and to continue learning while the vision behind OPEDUCA assumes that personal development benefits most from learning in one's own surroundings and in immediate contact with others. The creation of organic surroundings merges sources and structures that support learning taking place 'anytime, anywhere, with anyone and anyhow' (J. Eussen, personal communication, July 28, 2009).

Interviews, with the Director, Jos Eussen, and the Coordinator of Research, Jos Rikers, were done pertaining to the OPEDUCA project and its contents.

According to Eussen, the Netherlands has created top-down structures that are not always beneficial to young people. The regional force is often forgotten and it is therefore of importance to examine how youngsters can be offered better development opportunities when different areas (e.g. education, arts, culture and sports) start cooperating together at a regional level. The concept development around this idea has led to the creation of the OPEDUCA project. Informal brainstorm sessions, on for example ESD, showed that horizontal structures have to replace horizontal ones. The name OPEDUCA aims at a holistic approach, which is based on several pillars, such as 'KennissVlucht' (Flights for Knowledge), Business Class and 'LeerKracht' (Teacher) (J. Eussen, personal communication, July 28, 2009) and this structure is represented in Figure 6-3:

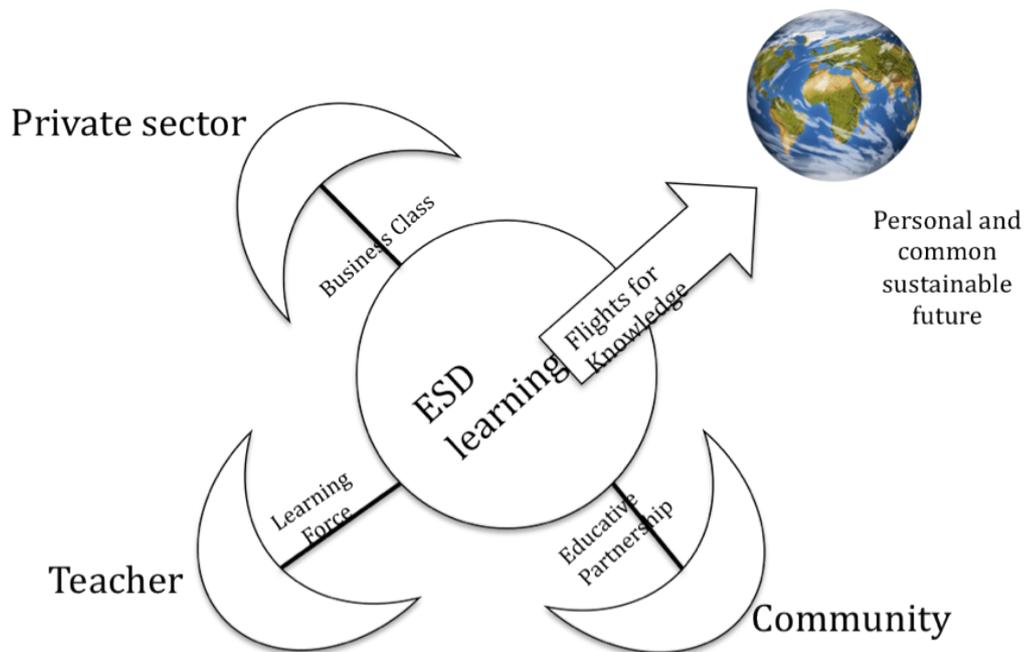


Figure 6-3 The structure of OPEDUCA

Source: Eussen (2009)

Schools choose with which pillars they want to work first. The first pillar Flights for Knowledge, as explained by Eussen, builds continuous learning lines. Topics come from future relevant themes. Open content, real life events and a 'life long learning' are important issues that this pillar revolves around (J. Eussen, personal communication, July 28, 2009).

Rikers indicates that the thematic approach differs from the traditional approach, thinking in subject areas, which is usually taken by science. Sometimes calculation skills need to be at forehand and sometimes knowledge from chemistry or law will need to be applied. Such an integral approach is needed within the field of SD. The different courses together offer a possibility to map out the whole theme and to find a solution to the problem.

The continuous learning line recognizes the different levels of students during their lifetime and what you expect a student to be able to do at such a level. At primary school, more emphasis will be put on stimulating interest. At secondary school this is taken one step further and students will have to think about the knowledge that they gathered and whether this knowledge is correct or not. Students are made curious after scientific evidence. With such a background, students arrive at university or, when they have a more practical background, 'HBO' (Higher Vocational Education) (J. Rikers, personal communication, July 6, 2009).

Flights for Knowledge need intervention in the learning process of the private sector, which forms the second pillar Business Class. In this pillar, it is of importance that you look at the added value of companies and connect their knowledge to the Flights for Knowledge. Excellent knowledge and information are present in science and business; these form educational sources for giving content and meaning to the topics of the continuous learning lines. The third pillar, Teacher, means that teachers really have to be knowledgeable about life itself. These types of teachers are multilingual, have travelled and know about media. This type of teacher also knows a lot about the human development. If the three pillars are connected in the live- and educational areas where people sleep and work, then you create the open learning surroundings (J. Eussen, personal communication, July 28, 2009).

According to Eussen, the youth of nowadays is so familiar with ICT, that the slogan 'Pen, paper, ICT' can be applied to youngsters. They know exactly how they want to work with ICT. It is therefore more important for organizations to know how to deal with technology. An organization should be challenged to innovate. A 'worldly' view on ICT is needed in this respect (J. Eussen, personal communication, August 4, 2009). According to Rikers, ICT has to be functionally embedded within education, otherwise the danger exists that it becomes a toy but does not have the purpose to support the educational process (J. Rikers, personal communication, July 6, 2009).

OPEDUCA uses an open source web to which pages can be added. The website will, in the future, allow users to upload and download text, pictures, movies and create blogs. Students can publish their work here. Such a site will provide students with more choices, variations, and 'good practices' and sharing opportunities, which is motivating and stimulating. In the educational process, it is the student who chooses which ICT-tool he/she wants to use. An expert will only need to possess the right electronic equipment in order to cooperate. The advantages of such an approach are that easy access is created and everyone can join in. The goal is to create cooperative learning (J. Eussen, personal communication, August 4, 2009).

When experts are involved in the educational process, OPEDUCA tries to combine persons with a background of scientific knowledge as well as from practice. The motor for the project to work with experts is the access of first-class sources. An expert is an authentic source when he delivers the best content available in a cooperative way. Students can, just as in the, by this

thesis covered, SvD project, check with experts whether their creation of the reality as they see it, is correct. The teachers and students then need to work together in order to check and place such knowledge and decide whether it is too difficult and meets the demand (J. Eussen, personal communication, August 4, 2009).

6.3 Summary

The IIIIEE offers two programmes that were examined by the thesis author and are planning to offer or already offer incorporation of experts' knowledge into the educational process. The YMP is a good example of the youth being involved in sustainability issues through distance education. The Programme acknowledges that solving such issues is not a linear process and therefore cannot be approached in this way. Students, when cooperating on working towards solutions for complex issues can have a whole range of ICT-ranged possibilities to support their efforts. Such possibilities include, amongst others, knowledge bases, methods, interviews with researchers, background documents and communities of feedback of teachers and students as key resources.

The E4SD course shows that it is important to have certain preconditions when organizing the involvement of experts through the use of ICT. Experts are chosen because their specialism fits into the subject of the course, participants all have a school diploma with relevant work experience and are provided with terminology basics at the beginning of the course. All these preconditions ensure that participants are able to understand the contributions of experts to the discussions and participants are able to catch up quite well.

Finally, OPEDUCA looks into ways of providing youngsters with better development opportunities when different aspects at a regional level are cooperating together. The programme supports the vision of learning taking place 'anytime, anywhere, with anyone and anyhow'. Flights for Knowledge offer thematic approaches, which build continuous learning lines. In this pillar, it is of importance that you look at the added value of companies and connect their knowledge to these Flights for Knowledge. The youth knows very well what the possibilities of ICT are nowadays, it is therefore up to the organizations to innovate in this respect. In the educational process, it is the student who chooses which ICT-tool he/she wants to use to contact the expert, and even if this expert is, in a manner of speaking, located in the middle of nowhere, the expert will only need the right electronic equipment to be able to contribute to the teaching process.

7 DISCUSSION

Chapter 7 discusses the main findings.

The conceptual model, which was based on the performed literature analysis, led to the creation of the following propositions:

P1: *The contribution of experts in the teaching process is useful and leads to desired educational outcomes.*

P2: *The identified ICT-tools (videoconferencing, chat, e-mail and forum) are used on a regular basis within the educational process.*

P3: *Experts can contribute to the educational process in a constructive and positive manner with the support of ICT-tools. However, some difficulties could be expected because of the differences between experts and students and the capacities of ICT-tools to deal with these differences.*

In analyzing the empirical research data, the conceptual model was useful particularly because it showed the author on which issues to focus within the collected data and it helped to structure the empirical results. These results will now be discussed.

Different sources, represented by different persons professionally involved with secondary education, point towards the relevance and importance of experts in the teaching process. There can be several reasons why this involvement is considered important. Students supported this consideration because they found the input they received for their project work of the experts valuable and incorporated their inputs into their project work. The examined ESD programmes, that include the use of ICT to offer their courses, also indicated the added value that experts can have for the teaching process. Examples of such advantages, according to these programmes, are that students could feel the motivation of becoming an expert themselves and experts form first class sources for students.

When it comes to the educational outcomes, students were asked whether they have changed their behavior towards the environment and their living surroundings. The outcomes to this question were a little bit mixed. Students recognized that the SvD project focuses upon environmental issues and thinking of creative solutions but also indicated that they did not change their own behavior because of participation. The following reservations will have to be made here. First of all, the project aims at an attitude change within students. Furthermore, it is probably a little bit too early to actually 'measure' the outcomes of the project in the sense of behavioral change.

All students' groups who had contacted experts had used the communication tool of e-mail to communicate their ideas and thoughts with these experts. Students indicated several advantages to the use of e-mail, such as that it is less likely that the e-mail gets lost and is a more accessible tool because a lot of people use it nowadays. Also the interviewed IVN-expert indicated that e-mail would preferably be the ICT-tool that he would use when cooperating in the SvD project. Existing ESD programmes showed the use of a forum which allowed interaction between experts and students but students are also encouraged to use the whole range of thinkable ICT-tools that could support students getting in contact with an expert.

The students who received feedback from experts indicated that this input was relevant and used it for their project work. However, in one case the provided information was partially

regarded to be too difficult by students to actually use. This could form an example of the different knowledge bases between high school students and experts and how the complexity of the project in which students get involved, also evokes feedback of experts which include more complex knowledge. In this case, students had used e-mail to contact the expert, which allowed students to contact an expert who is located in a different continent than them. However, e-mail did not allow the expert to support the students in their learning process and did not offer students enough 'grip' to actually understand all the information that was provided for within the document.

Several safeguards can be identified within existing programmes that ensure, both on the side of the experts as the students, that ICT-tools can be most optimally integrated within the teaching process. Experts could be filmed and questions should be asked over and over again during this process in order to really make their knowledge understandable for students. Students are provided with a glossary list, which allows them to all start from the same level of understanding. Teachers and students then need to work together in order to check and place such knowledge and decide whether it meets the demand.

8 CONCLUSION

Chapter 8 concludes the thesis by giving the main conclusions, recommendations and issues with respect to future research.

8.1 Main Findings

The research question of this thesis is repeated here:

“How can ICT approaches support the integration of experts’ knowledge into high-school sustainability (-ESD-) projects of NGOs?”

Both the literature review as empirical data collection revealed the importance of experts taking part in the teaching process, which can for example be created through the organization of field trips. However, as ICT-tools become increasingly efficient, effective, less expensive and younger generations are more knowledgeable about their use, such tools should be increasingly used in education, and perhaps, especially for ESD. Ways of integrating experts’ knowledge into the classroom through the help of ICT-tools therefore need to be examined.

Different ESD programmes that were studied which use ICT in their education do not limit the use of ICT-tools but offer a whole range of opportunities for students to get in touch with experts. Several approaches were considered or have already been implemented. Asking experts the same question again and again while filming can help in the creation of movies that can be stored in a database. This approach, with the support of the storytelling method, is also endorsed in literature. Students will be able to retrieve the, for them relevant, knowledge, data and facts from these sources. This is however a very cumbersome process; it does not allow students to have direct contact with the persons representing these experts. The movies will have to be filed and a database maintained. It is clear that such an approach is not the cheapest solution for any organization.

Another approach used within the examined programmes showed that students are encouraged to use anything suitable in the form of ICT to contact experts. It is hereby essential that teachers will be available to help and guide students through such a process. When students know which product they will have to deliver in order to finish the project and will not receive any extra bonus points for contacting experts, it could happen that they will not even try. When the experts are contacted, it is often through ICT-tools, practice has revealed, that do not allow any audio/visual contact between the parties communicating with each other.

Rich media tools, more and more, create the possibilities for expressing tacit knowledge between persons who are communicating through the use of ICT. However, it is only the question how much of such knowledge can be really understood and grasped by high school students in for example an audio-video Skype meeting of half an hour. Furthermore, practical dilemmas, like time issues, would make it difficult for an expert to cooperate with such a meeting in the first place. The examined SvD project does provide students with a ‘Bronnenboekje’ in which experts are listed which offered their cooperation to the project. However, in practice it turned out that some students either felt that the choices between experts were too limited or that students did not receive a reply from experts when they had tried to contact them through the use of the ‘Bronnenboekje’.

The differences between students and experts, the characteristics of tacit knowledge and the goals of an ESD approach such as the SvD project make it questionable whether it is always the aim of such approaches to integrate the whole knowledge basis of experts into the educational process. The role of an expert, who is contacted by students solely through the use of ICT-tools, in a project such as SvD can also be one of an ‘eye opener’ for students, teaching them that they should ask questions about their living surroundings, the way things are arranged and how things can be improved in order to work towards sustainability. The willingness of students to show openness and their affinity with the issues they are working on, are also important issues that would accelerate this process. This does not mean that the original roles that the SvD project ascribed to experts should be forgotten or neglected.

However, it was revealed in the literature that organizational knowledge creation does lead to innovations within companies. If there is one thing that the field of ESD needs, it is innovative solutions in order to solve difficult and pressing issues that form direct threats to our world. Therefore, it is very relevant to keep examining ways that ‘capture’ this tacit knowledge so that as many people as possible can take advantage of this knowledge.

8.2 Recommendations

The conducted research leads to the possibility to compose the following Table 8-1 that includes the main actors which are involved in bringing ESD to the classroom, the main receivers of this type of education and the contributions of experts and ICT-tools in this sense.

Actors	NGO	Students	Schools	Experts
Fields				
ESD	<ul style="list-style-type: none"> • Communicate internal knowledge of employees that can help strengthen the educational process • Realize ESD goal, objectives and the variety in approaches • Evaluate projects' success on educational outcomes 	<ul style="list-style-type: none"> • Need some basic understanding of SD concepts in preparation of the project 	<ul style="list-style-type: none"> • Consider better integration of ESD in education for now and later • Teachers should realize that ESD is a process and not a finalized product • Teachers should preferably be enthusiastic about content and process 	<ul style="list-style-type: none"> • Understand how they can contribute to interdisciplinary education • Show real involvement in the ESD project
Experts' knowledge	<ul style="list-style-type: none"> • Realize a better link between the projects' goals and experts • Make better use of the potential of experts' knowledge • Understand that experts possess different types of knowledge 	<ul style="list-style-type: none"> • Need to be serious and prepare their work in advance • Will need some preliminary information of the expert in advance 	<ul style="list-style-type: none"> • Provide guidance to students when communicating with experts through the use of ICT 	<ul style="list-style-type: none"> • Realize that students have a different level of understanding and background knowledge
ICT-tools	<ul style="list-style-type: none"> • Create an online platform which includes different ICT-tools • Support schools in the incorporation of ICT-tools in the educational settings • Train staff members in existing and emerging ICT-tools • Guide the experts with respect to ICT-tool selection and use 	<ul style="list-style-type: none"> • Understand how various ICT-tools can be used to communicate with experts • Students should all use or start using ICT in the classroom 	<ul style="list-style-type: none"> • Understand the different ICT-tools that can be used in the classroom and their pros and cons • Make ICT-tools easy accessible 	<ul style="list-style-type: none"> • Know how to work with ICT-tools • Understand the capacities and limitations of ICT-tools

Table 8-1 Recommendations

The main findings and depicted Table 8-1 lead to the following recommendations that can be made by the author for NGOs that want to be involved in offering ESD through the help of

ICT and hereby include the knowledge of experts. Most of these recommendations focus on ICT and experts' knowledge and some form general recommendations.

1) ICT & experts

- A. An NGO could invest money, time and effort in creating a database where movies are stored of experts talking from their experiences and fields of expertise about issues contributing to the NGO's project. However, electronic equipment, the knowledge about how to create such a movie, experts themselves and a database which will have to be maintained, are all conditions that need to be in place in order to realize this option. When such an approach is too broad for NGOs, other options will have to be created which still allow the involvement of experts.
- B. When experts involved in the project have given their consent to direct contributions during the project's running time, several direct options can be thought of which include the direct involvement of the experts in the teaching process. Examples of ICT-tools have been mentioned under section 4.3 ('ICT-tools'). In order to really make students aware of such possibilities, it would be a good option for any NGO to create a specific website for the project which includes all the different ICT-tools. Such a website could also include a Frequently Asked Questions (FAQ) and glossary lists which explain the most important concepts, ideas and definitions on SD.
- C. Experts and teachers will also need to learn about the range of ICT-tools that are available and what the advantages and disadvantages are of these tools. In order to create this awareness and understanding, an NGO can for example develop a short manual of a maximum of two pages, which explains what the capacities and limitations of ICT-tools are. Such a manual could also include short technical advises on how to install the different tools on their computer if experts have not already done this.
- D. Experts, because of their developed qualities and experience, possess a different kind of knowledge than students which is important for them to realize when they want to help students on their way with the support of ICT-tools. ICT-tools have limitations and experts will have to keep this in mind when students want to use ICT-tools to get in touch with experts. Facts can be shared but it is already harder to share experiences through the support of ICT. However, inspiring and motivating messages can empower students and form an 'eye opener' for them about how things are done and how things could change. This is a role that should not be forgotten by any expert contributing to education.
- E. An NGO that wants students to work with ICT, will also have to know what the goals are of these efforts, what the best ways are to involve students with ICT and should be able to advise the schools on such issues as well. It is therefore important that employees of NGOs are educated about the possibilities that the world of ICT can offer to them, their projects and schools involved in their projects. Within an NGO, it is not unlikely that several employees work better with ICT than others. These employees could be asked to create several little workshops for other employees in order to get everyone at the same level of understanding. An employee of the ICT department could of course also perform this role.
- F. NGOs could create a website which functions as a database and allows students to share the outcomes to their project work, choices on knowledge sources and sharing opportunities. Such a website can form motivating and stimulating factors for learning.

Students and teachers can comment on each other's work through this website which could be a discussion starter. This way, perhaps not a 'window to the world' but a window to the specific country in which the NGO is active, could be created.

2) General recommendations

- G. NGOs which have a lot of knowledge 'in the house', through the backgrounds and experiences of their volunteers, should disclose this knowledge on a much broader basis for all kind of projects that are run by the NGO. Volunteers could be made aware of these possibilities when they first start working for an NGO or a database could be set up which indicates the availability for different projects and the specific field/areas of work of volunteers. A better match between opportunities within projects for disclosure of knowledge and contributions of volunteers will have advantages for the functioning of these projects.
- H. Before experts give their consent to cooperate in the project, they should be made aware of several facts, such as the minimum and maximum amount of time they could and should spend on this cooperation in order for the project to gain positive results and make such contributions really valuable for the project. Experts should also be explained about the content, plan and learning of the project and how their assigned tasks relate to these aspects of the project.
- I. An NGO should not forget, when the organization wants to work with ESD, what the core of this vision and where it finds its basis, namely in sustainable development. When this aspect starts 'dangling' at the site and students focus more on the project work, the presentation and final outcomes, then the project should take a closer look at its contents, the way it is presented at high schools and its implementation within these high schools. This action could be undertaken together with the high school teachers who are running the project.

8.3 Further Research

Several indications for further research can be given here.

First of all, it is actually a little bit too early to already discuss the behavioral changes that students undergo after taking part in the SvD project. This could be evaluated by IVN a while after the students have taken part in the project and have matured more.

Second, several ICT-based possibilities have been discussed under section 4.3 ('ICT-tools') and identified as possessing added value to the teaching process. Further research could look into the way that experts can contribute in creative ways to the teaching process through the use of these ICT-based possibilities.

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Abbreviations

DESD	Decade of Education for Sustainable Development
ESD	Education for Sustainable Development
E4SD	Energy for Sustainable Development
FAQ	Frequently Asked Questions
ICT	Information & Communication Technology
IIIEE	International Institute for Industrial Environmental Economics
IIS	International Implementation Scheme
IVN	IVN Natuur en milieueducatie
MSN	Windows Live Messenger
NGO	Non-Governmental Organization
NME	Natuur- en milieueducatie
PC	Personal Computer
RCE	Regional Centre of Expertise
SD	Sustainable Development
SvD	Scholen voor Duurzaamheid
SECI	Socialization, Externalization, Combination and Externalization
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNU	United Nations University
UNWCED	United Nations World Commission on Environment and Development
USA	United States of America
YMP	Young Masters Programme

Appendix

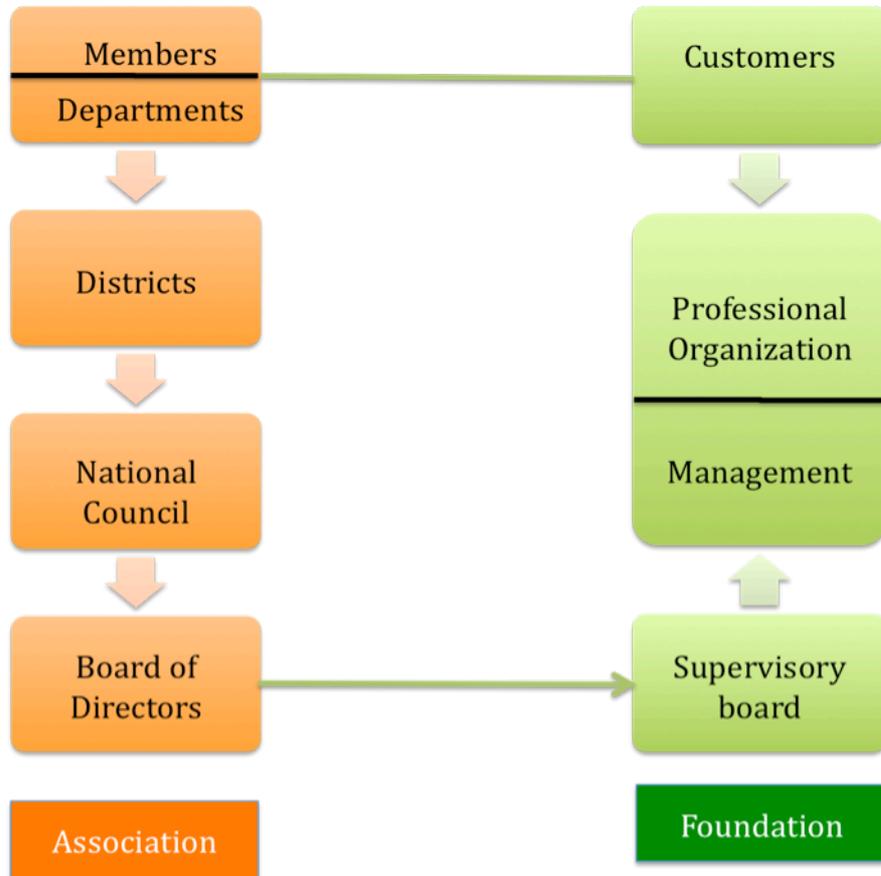


Figure 11-1 Organizational structure IVN

Source: IVN Nederland (2008)

Organization	Date	Type	Name	Position	Duration
IIEEE	06/05/2009	In person	Paola Mendoza	Course Manager	1 ½ h.
	06/05/2009	In person	Torvald Jacobsson	Director	1 h.
	11/05/2009	In person	Lars Strupeit	Course Coordinator	½ h.
	11/05/2009	In person	Katsiaryna Paulavets	Course Coordinator	½ h.
Libanon Lyceum	16/06/2009	In person	Nilton Ramos	Student	¾ h.
	25/06/2009	In person	Thomas van Duijn	Student	½ h.
	25/06/2009	In person	Bas Arts	Student	½ h.
	25/06/2009	In person	Paul Scharff	Rector	¾ h.
Driestar College	18/06/2009	In person	Martin van der Grond	Teacher	½ h.
	18/06/2009	In person	Claudia van den Berg	Student	½ h.
	18/06/2009	In person	Peter Crum	Student	½ h.
	18/06/2009	In person	Maria Bos	Student	½ h.
	18/06/2009	In person	Gert van Vliet	Student	½ h.
UNU and RCE Rhine-Meuse	06/07/2009	In person	Jos Rikers	Director Research	1 h.
	28/07/2009,	Telephone	Jos Eussen	Director	1 h. + ¾ h.
	04/08/2009				
	12/08/2009	SKYPE	Brendan Barrett	Head of Office	½ h.
IVN	09/06/2009	In person	Daphne Teeling	Regiomanager IVN West	¾ h.
	31/08/2009	Telephone	Lida Blok	Programme Manager	½ h.
	04/09/2009	Telephone	Arthur Hilgersom	Volunteer	¾ h.

Table 11-1 List of interviewees