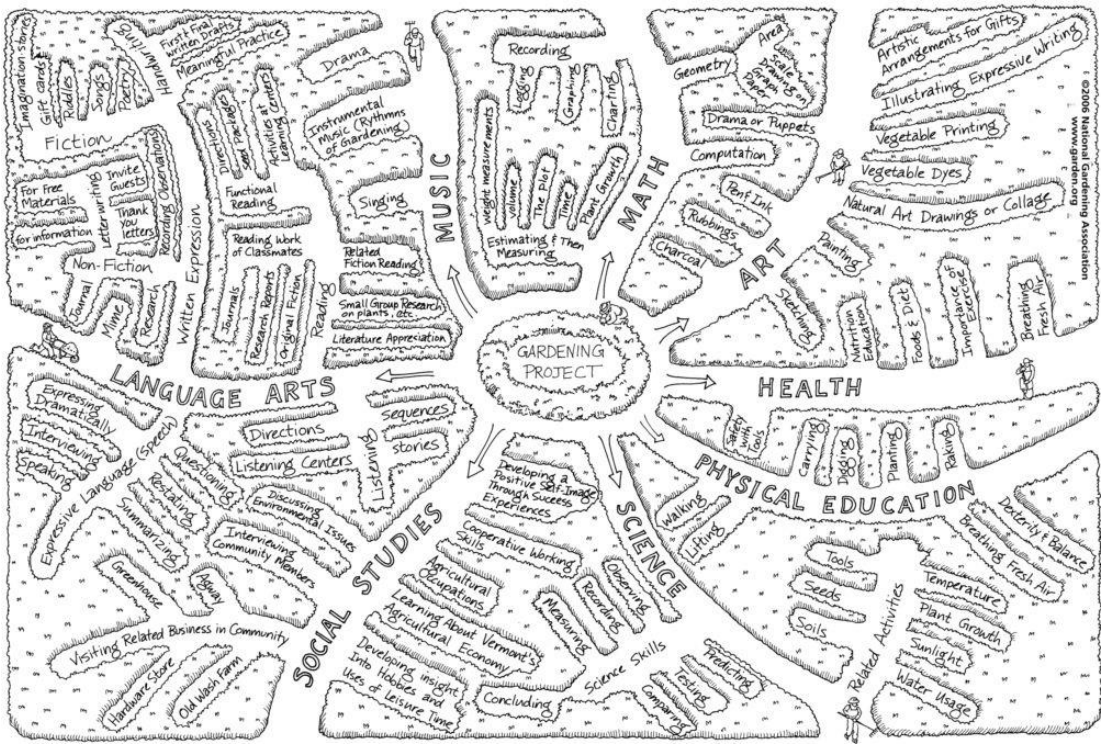
Exploring how school gardens are integrated into secondary schools



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Abstract

School gardens are sprouting up everywhere, yet little is known about the phenomena of gardens as a teaching tool in secondary schools. This research seeks to examine how school gardens are integrated into secondary schools in the United States and the Netherlands. An inductive approach was taken and nine case studies conducted using a semi-structured interview. Secondary school gardens cases were examined along three lines of questioning to determine how they are practically, structurally and ideologically embedded within the schools. As a result, it is postulated that school gardens can facilitate learning in a community of practice and are a microcosm of civic ecology. They provide students with the opportunity to participate in, and contribute to their communities in a result-oriented and hands-on manner that connects both local and global social and ecological issues. Additionally, a theory on the stages of development of school gardens was postulated. This research documents nine examples of school gardens in secondary schools and provides recommendations, which are meant to serve as guidance for the development of current and prospective school gardens.

Key terms: School garden, secondary education, garden based learning, community of practice, civic ecology

Acknowledgements

Perhaps unbeknownst to him, Arjen Wals provided the initial inspiration for this research. Before coming to the Netherlands to pursue a Masters, I read and was inspired by his work on education for sustainable development. This helped me to connect the topics that I am passionate about and find a way to make a meaningful contribution through my studies. Petra Derkzen helped me to sort and develop the initial plan for this research. Lummina Horlings gave me the time and space I needed. She also provided much appreciated input and feedback in my attempts to sort and make sense of the research findings. Ichsani Wheeler was invaluable in the formatting process through her persistent wrestling with Word. I am eternally grateful for Wanka Lelieveld's kind, gentle and endless support and for his help in the realization of *Wortels in Onderwijs*. Last but certainly not least, I would like to thank Nuffic for making it financially feasible for me to come to Wageningen and the Dutch society for welcoming me with open arms.

1. Introduction

School gardens have a long history within our education system and are presently experiencing a resurgence of interest. The reason for this is because the gardens are seen as a way to teach students about agriculture, science, nutrition, environmental sciences and healthy living (Graham, 2005). The connection between the school garden and the curriculum is currently receiving more attention than in the past and gives schools the ability to innovate and increase the educational function of their campus. From a pedagogical perspective, school gardens are commonly associated with experiential education and environmental education (Desmond, 2002). The connection between the garden and curricula through experiential education is the focus of this MSc research.

Recent studies on school gardens focus primarily on elementary schools (ages 5-12) (Waliczek, 2000) (Blair, 2009). Within this body of peer-reviewed literature, the dominant focus is how school gardens can positively influence children's attitudes about food and nature and increase physical activity of children (Hermann, 2006; Ratcliffe, 2011; Libman, 2007; Ozer, 2007; Robinson-O'Brien, 2009). Despite the many potential positive influences of gardening on children, fighting obesity is a common legitimation in both elementary and secondary school garden programs (Graham, 2005). However, it in reality the focus of school gardens in secondary schools is on learning and not on combating obesity.

Of particular interest are in school gardens at the secondary school level because this is a crucial time in education where the students are learning to question things, think critically and form opinions of their own. This is also the time when lifestyle habits begin to form and school gardens may have a positive effect on students' habits at such a critical time in their lives. Teaching healthy lifestyles is commonly used as the justification for the school gardens. However secondary education in our Western society is generally focused on teaching for standardized tests, rather than teaching students how to be healthy people. This dichotomy can put a school garden at odds with a school; therefore it becomes important that the garden is tied to the curriculum as a vehicle to teach other subjects such as, math and science.

That being said, the focus of this research is not to validate whether or not school gardens have a positive effect on students' health, but on how these gardens are practically, structurally and ideologically integrated into secondary schools. School gardens were analyzed along three axes; the strength of the connection to the internal and external community (practical), their focus on the development of skills versus knowledge (structural); and their emphasis on civic ecology (ideological). Consequently a theory on the development of school gardens was formulated. This theory could be useful in the assessment of how the focus, challenges, needs and opportunities of school gardens evolve over time. This could serve as a basis for guidance for school gardens.

1.1 Problem statement

School gardens are sprouting up everywhere and are becoming increasingly popular in both the United States and the Netherlands. Tackling obesity is commonly used as a legitimation for their inception, despite the lack of scientific evidence supporting this intervention. The bulk of the literature on school gardens focuses on examining the effects of school gardens on the vegetable consumption of elementary school-aged children. Often there is a wish that the school gardens be (more) integrated into the curriculum as a way to teach health and science, yet there is little research and or guidance as to how this can be done successfully at a secondary school level. Secondary school curricula are primarily developed around state dictated learning goals, leaving little flexibility or room for the implementation of a garden. This research aims to shed light on how schools have been successfully integrated into secondary schools.

As such this research is a comprehensive examination of gardens within a secondary school context, to understand how the gardens have been successfully integrated into the school. In the search for case studies it became clear that the term school garden (in relation to secondary schools) was loosely defined and poorly understood. In the search for case studies many cases emerged where the garden was either no longer in existence or where a garden was only used as an observational tool in a minimal amount of lessons, thus not an integral part of a school. These cases were not explored. Moreover, a set of criteria for successful case studies was defined.

1.2 Definition of terms

School garden
The Food and Agriculture Organization (FAO) defines school gardens as cultivated areas around or near schools and tended at least partly by students (FAO, 2010). For purposes of this research, this definition is expanded to also include both greenhouses and container gardens located both on and off campus as long as the students utilize them through their school's educational activities.

Garden based learning
Garden based learning (GBL) is defined as an instructional strategy that utilizes a garden as a teaching tool (Desmond, 2002). Gardens are often used to teach subjects including, math, science, agriculture, social science, environmental science and nutrition. This is usually associated with experiential education pedagogy (Desmond, 2002).

Experiential education
Experiential education is a philosophy that informs many methodologies in which educators purposefully engage with learners in direct experiences. Focused reflection is used in order to increase knowledge, develop skills, clarify values, and develop people's capacity to contribute to their communities (Association for Experiential Education, 2012).

Civic ecology
The term civic ecology refers to small-scale, self-organized stewardship practices that integrate environmental and social values in cities and other peopled landscapes. This term also reflects the linked social and ecological systems implications of urban participatory environmental restoration and management initiatives (Kransy, 2009).

1.3 Knowledge gap and relevance

The bulk of the peer-reviewed papers on this topic are examine at gardening in primary schools rather than secondary schools and has been conducted in the United States (Langellotto, 2012). Much of this research seeks to provide evidence that participating in school gardening increases the vegetable intake and physical activity of elementary school-aged children (Waliczek, 2000). In addition to this, research has also been conducted on the effects of community gardens on community members (Pudup, 2007).

Despite the abundance of knowledge on gardening and education and the importance of the two when combined, there is a knowledge gap where school gardens and secondary schools connect. As so little information is available on the integration of school gardens at these educational and organizational levels, it is important to begin with a contextual analysis of how the garden fits into secondary schools. For this reason, this research examines the integration of school gardens in secondary schools both in the United States and the Netherlands.

In addition to the lack of knowledge of how school gardens are integrated in secondary schools there are also questions regarding how GBL can support the health goals of schools. The Healthy Schools movement in the Netherlands is becoming increasingly popular (GGD, 2014). School gardens are often included at the primary school level but not at the secondary level. At the secondary school level the focus is on developing healthy lifestyles and avoiding unhealthy habits.

Further evaluation of the individual projects can be done once more information has been gained on what the relationship is between school gardens and secondary schools. For instance a school garden project, despite everyone's best efforts is set up to fail if the garden does not fit within the educational ideology of the school. If it is already too far of a leap to get students out of the classroom to learn, or if the school sees GBL as a form of an agricultural education only meant for rural students then the garden might not be easily integrated into the educational framework of the school.

This research seeks to document examples of school gardens that have been successfully integrated into secondary schools. When more information is known about successful projects, then success stories and lessons learned can be shared amongst current and prospective schools.

1.4 Main goal and research questions

The primary research goal is to describe and compare successfully integrated school gardens within secondary schools both in the United States and the Netherlands.

Research question

How are gardens integrated in secondary schools and their curricula in the United Stated and the Netherlands?

Sub research questions

- How are school gardens organized on a practical level?
- How is the garden embedded within the educational institution?
- How does the garden fit within the educational philosophy of the school?
- How do school gardens develop over time?

1.5 Research objectives

The objectives of this research are as follows:

- To describe examples of both American and Dutch school gardens in secondary schools,
- To develop a framework for comparison of different school gardens,
- Develop a theory on the stages of development of a school garden,
- To establish a list of recommendations for school gardens.

2. Methodology

This research is a qualitative research project that utilizes case studies as the research method. Case studies are the preferred strategy when 'how' and 'why' questions are posed (Yin, 1984). The data collection techniques include observation, semi-structured interviews and collection of secondary data source material such as lesson plans and information about the schools. From this multi-case study design in which nine examples of schools gardens, five in the United States and four in the Netherlands were chosen for this research (**Table 1**).

For the purpose of this research, an integrated school garden project is one where:

- The school garden has been integrated into the curriculum for a minimum of 1 hour per week;
- The garden is older than one year and is projected to stay for several years to come;
- Both the students and staff see clear advantages/benefits from the garden.

The case studies were chosen based on meeting the criteria of a successfully integrated school garden. These cases were chosen to represent the wide variety in school gardens in secondary schools. They vary in location, focus, size (school, garden and class size), development stage and resources, and socio-economic status. The schools also vary in type; there are both public and private as well as college preparatory and vocational schools represented in this research[1].

Due to the lack of scientific literature on the integration of school gardens in secondary schools, an inductive research approach was taken. An inductive approach begins with the observations, and theories are formulated towards the end of the research and as a result of observations (Goddard, 2004). No hypothesis was postulated at the initial stages of this research; in contrast the starting point was empirical manifestations from which a theory was derived. Upon completion of the data collection process the data were analyzed for emerging patterns from which explanations were developed and a theory was derived.

The theoretical implications of this thesis can be used to inform and advise school garden projects. The conclusions and recommendations create opportunities for school gardens to adapt their strategies.

[1] A brief description of the structure of the school system in both the United States and the Netherlands is provided in the following section.

Table 1. Overview of school garden case studies.

Case	School	Location	Role of key informant	Observational setting	Student no. & age
US1	Boise High School	Boise, ID, USA	Environmental sciences teacher	Classroom & garden	250; 15-18 yrs.
US2	Community School	Ketchum, ID, USA	8th grade teacher	Classroom & garden	25; 13-14 yrs.
US3	Sage School	Hailey, ID, USA	School director/teacher	Classroom & garden	63; 14-18 yrs.
US4	Shorecliffs Middle School	San Clemente, CA, USA	7th grade life sciences teacher	Classroom & garden	200; 12-13 yrs.
US5	Martin Luther King Jr. Middle School	Berkeley, CA, USA	Program coordinator	Garden	950; 11-14 yrs.
NL1	Pantarijn	Wageningen, NL	VMBO 'green'/Practical education teacher	Classroom & garden	125; 12-18 yrs.
NL2	Ichtus College	Dronten, NL	Sciences; biology, mathematics, chemistry and physics teacher	Classroom & garden	500; 12-18 yrs.
NL3	Chr. Lyceum Apeldoorn	Apeldoorn, NL	2 middle school biology teachers	Classroom & garden	270; 12-13 yrs.
NL4	Segbroek College	Den Haag, NL	Middle school biology, NLT teacher	Garden	200; 12-18 yrs.

2.1 Structure of secondary schools in the United States and the Netherlands

Since little is known in the literature about how school gardens are integrated into secondary schools, it is useful to take a step back and look at how the school system is structured in both the United States and the Netherlands. This section provides a brief description of the school system in both countries.

In both the US and the Netherlands secondary education is for students between the ages of 12-18. The school type can be further divided into public or private schools based on their funding source (**Table 2**). In addition to the funding differences, public and private schools vary greatly in terms of pedagogy and curricula. In public schools the curricula are regulated by the state, whereas private schools have more freedom in both teaching methods and curricular content.

Table 2. Funding sources in public and private schools.

School type	Funding source
Public	Government (through taxes)
Private/independent	Tuition or donations

As outlined in **Table 3**, the difference in the US between junior high school, middle school and high school is the age range that these schools serve. Whilst in the Netherlands, there is a greater variety within the types of secondary schools as is illustrated in **Figure 1**. In the US when students leave elementary school they enter either middle school or a junior high school; which is dependent on what schools are present in the area. A description of the different types of schools can be found in **Table 4**. In the Netherlands, when a student leaves elementary school they will enter LWOO, VMBO, MAVO, HAVO or VWO depending on their performance. They will then move through different levels on the Dutch school system based on how they progress. This learning trajectory can take many paths and can range between 4-6 years depending on the student.

Table 3. Structure of the American education system arranged by education stage school type and age of the students

Education stage	School type	Ages in years
Primary education	Elementary school	6 - 12
Secondary education	Middle school	10 - 13
	Junior high school	12 - 15
	High school	14 - 18
Tertiary education	Vocational technical school	18 +
	Junior college	
	Community college	
	University	

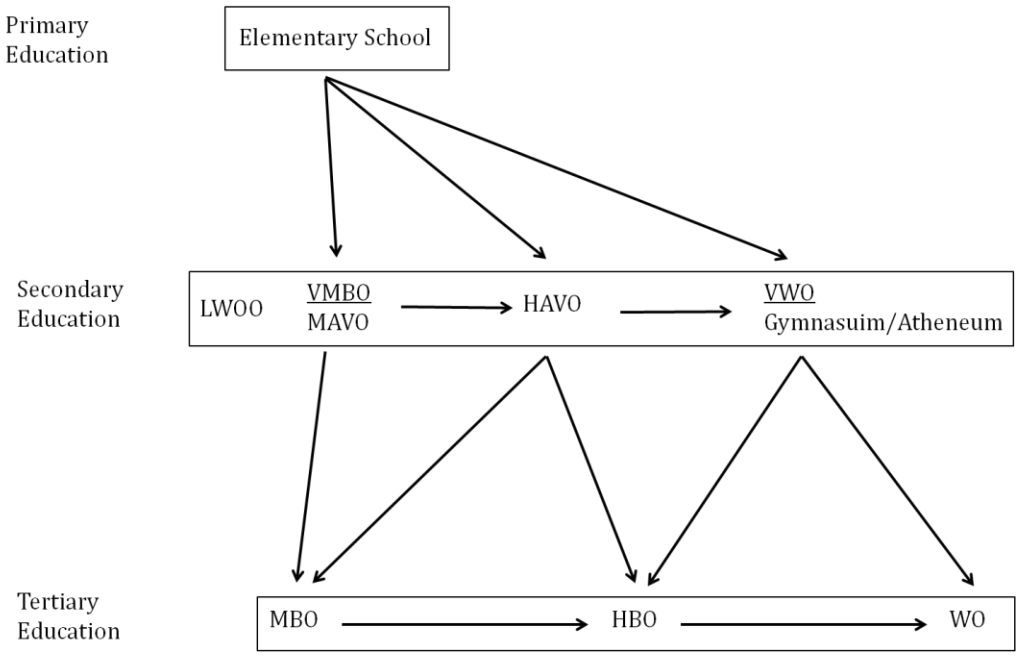

Figure 1. Levels of the Dutch school system.

Table 4. Dutch school types.

School type	Dutch name	English translation
LWOO	Leerwegondersteuned onderwijs	Learning supported education
VMBO	Voorbereidend middelbaar onderwijs	Preparatory secondary education
MAVO	Middlebaar algemeen voortgezet onderwijs	General middle secondary education
HAVO	Hoger algemeen voortgezet onderwijs	General higher secondary education
VWO	Voorbereidend wetenschappelijk onderwijs	Preparatory academic education
MBO	Middelbaar beroepsonderwijs	Secondary vocational education
HBO	Hoger beroepsonderwijs	Professional education
WO	Wetenschappelijk onderwijs	Academic education

2.2 Data collection

The level of study chosen for this research is the school garden, which is an embedded unit within the school. The data were collected at the schools (in either the classroom or garden) from key informants (1-2 teachers or program administrators) who had the most knowledge of and involvement in each school garden program. The interviews, which averaged 40 minutes, were audio-recorded and subsequently transcribed. At each school, observations of activities were taken as notes and photographs. Secondary data, such as associated lesson plans and evaluation materials, were also collected. The interview data were interpreted by unifying/coding the responses and noting the themes that emerged (Silverman, 1993). The data was analyzed along the three levels of questioning described in the following section.

2.3 Deconstructing the school garden

To establish how school gardens are integrated into secondary schools the case studies were examined from three distinct levels: practical, structural and ideological. These levels of questioning are relevant in light of the research questions and objectives and the data gathered provides a broad picture of how school gardens are integrated into secondary schools. The following section describes each level and lists the questions asked at each school.

Practical

To gain an understanding of how the garden is organized on a practical level the following questions were asked:

- Where is the garden located?
- How big is the garden?
- How far is the garden from the school?
- How many pupils and at what age do they participate in the garden?
- How much time do pupils spend in the garden?
- What is produced in the garden and how much?
- What happens to the produce that is grown in the garden?
- Do the students have any say over how or what is grown in the garden?
- How long has the garden been in operation?
- How is the (maintenance) schedule of the garden arranged?
- Are the students involved in the garden either after school or during the summer holidays?
- Whose responsibility is the maintenance of the garden?
- Is there any collaboration between the garden and the school food service or on-site cooking facilities?

Structural

To gain an understanding of how the garden is imbedded within the educational institution the following questions will be asked:

- Who decides which students go on to the next grade level?
- How is the curriculum built?
- Who decides what content is in the curriculum?
- Do teachers have flexibility (to implement new lessons or methods) within the curriculum?
- Does a school garden fit within all levels or is there a type of school that is particularly well suited for garden based learning?
- Which age levels participate in the school garden?
- Are there enough available lessons and teaching materials for garden based learning?
- Where do these teaching materials come from?
- Who funds the school garden?
- Is the garden reliant on external grants for continuity?

Ideological

Within each school no matter which level there are ideological norms that affect and shape the education. These ideological norms/values may have a strong effect on whether or not garden based learning is primed for success or failure. This level of questioning is meant to unpack how the garden fits into the ideological framework of the school.

- What is good education?
- What is the mission of the school?
- How does the garden fit into the overall learning objectives of the school?
- What are they preparing the pupils for, i.e. practical skills or standardized tests?
- Who initiated the garden and why?
- What is the overall purpose of the garden?
- Is the garden seen as an addendum to the curricula or an integral part of it?
- How does the school garden teach the students to be good consumers or active participants in the food system?
- How is the success of the garden monitored?

3. School garden case studies descriptions

In this section the case studies in the United States are described first, followed by the case studies in the Netherlands.

3.1 School garden case studies in the United States

Boise High School in Boise, Idaho, USA

For the past three years the environmental science students of Boise High School get to leave class, go outside, take a five minute walk and experience gardening at the Downtown Teaching Farm[2] (**Figure 2**). Boise High School (BHS) is the oldest of five high schools in Idaho's state capital city. The school is situated in an urban area and the garden is located across the street from a church in a residential neighborhood in downtown Boise. BHS is a large school with 1.480 students between the ages 15-18 years of which approximately 250 students participate in the school garden through their sciences classes. These students participate in the garden at least once per year however many students are more actively involved. The garden is the size of ¼ city block, which is approximately 1000 m^2.

Figure 2. Downtown Teaching Farm in Boise, Idaho. Photo credit; The Downtown Teaching Farm.

The Downtown Teaching Farm was the initiative of two environmental science teachers. The plot, which is owned by a local church where one of the teachers is a member, was used as a community garden. However the garden was in need of new leadership. The two

[2] The Downtown Teaching Farm is comparable to an urban organic community garden rather than a farm. They use organic methods but the farm/garden is not certified. No products are sold through conventional food distribution chains therefore certification is not relevant.

teachers saw this as a wonderful opportunity to transform a plot in disrepair into a teaching farm. The land was leased to them for free and they wrote a grant to cover the initial costs of setting up the space.

Mostly annual vegetables and a small bit of fruit are grown in the garden. There is enough produce grown for approximately 30 families. Students and volunteers at home eat the bulk of the produce; however once per week the harvest is donated to the neighboring church where it is then cooked into delicious meals for refugees and those in need in the community.

For the most part, the students just work in the garden and do not have any say in what is produced in the garden. They get to learn how to garden and grow food under the supervision of their environmental sciences teacher and experienced gardener. Although Idaho is a rural and agricultural state, many of these students are removed from agriculture and are unaware of how food is produced. Working the garden is a chance for them to reconnect to food.

Currently there is no collaboration between the school's food service and the garden. There are facilities on site at the school and there is a desire to integrate the produce into the school food service. However this will require more cooperation with the school and the food service provider. The meals are planned one year in advance, thus any planned collaboration would need to fit into the long term planning of the Downtown Teaching Farm and the school's food service provider.

BHS is a public school, meaning that it is funded by the state and must adhere to the state mandated curriculum. Currently what the students learn in the garden is seen as an addendum to the sciences curriculum. The teachers can only take the students out of the classroom and into the garden once the mandated curriculum has been covered, in practice this means that the teachers try to get through the lessons in the book quickly and leaving extra class time that can be spent in the garden. Some science labs are taught in the garden but for the most part the seasonal tasks of the garden dictate the lessons of the day. Often the produce from the garden makes its way back into the classroom where the students get lessons on compost and seed saving (**Figure 3** & **Figure 4**).

Figure 3. Vermicompost in the classroom.

Figure 4. Potatoes in the classroom. Harvest records will be kept and the potatoes will be used for seed.

There is no set schedule for the students to work in the garden and the community volunteers have arranged a schedule amongst themselves to ensure that the garden is maintained. Beyond school hours the students are not required to participate in the garden, however a few of the students who live close by are more actively involved throughout the growing season.

Despite only being seen as an addition to the standard lesson plans the garden fits well into the school's learning objectives by focusing on character development and community involvement. The Downtown Teaching Farm is currently considered a success because it gets students actively participating in their community and is projected to stay for the coming years.

Community School in Ketchum, Idaho, USA

Community School is a small school in Ketchum, a small affluent mountain town in central Idaho. The school is private meaning, that it is not bound by the same stringent regulations as publicly funded schools. The tuition for the upper grades is approximately $27.000 per year.

Since 2010, 25 8th graders (13-14 years) have had a greenhouse and a few raised beds attached to their classroom. Unlike how most school gardens come about this project was proposed by the students and is an integral part of their curriculum. The 8th grade curriculum at this school is centered on what they call a Food Unit. The Food-Unit is a teacher designed inquiry-based curriculum in which the students learn about the practical realities of the food system. For example;

- Civics lessons are based on the Food Bill, the main agricultural policy document in the United States.
- The students take an in-depth look into the social and environmental consequences of the current food system.
- The students detect and calculate the type and amount of sugars in commonly consumed sugary beverages as part of math and chemistry lessons.
- The students choose a commonly consumed food product and take a deep look into the ingredients; they identify what each ingredient is, where it comes from, how it is produced and possible environmental impacts of production methods, and analyze the contents and recyclability of packaging materials (**Figure 5**).
- The students together with their teachers and a few parents designed and built a greenhouse where they can grow, use and sell produce (**Figure 6**).

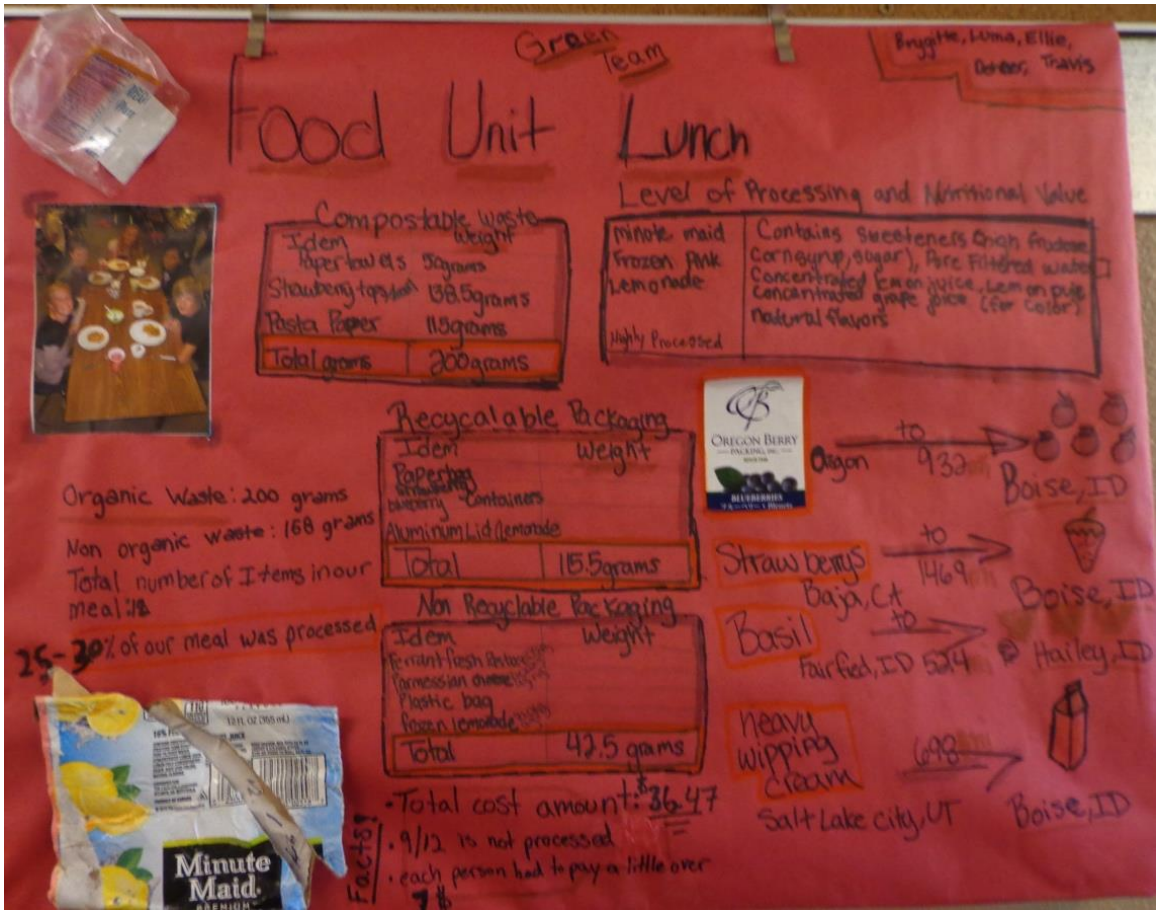

Figure 5. Student poster for Food Unit assignment analyzing the contents of a lunch.

Figure 6. Greenhouse attached to the classroom at the Community School in Ketchum, Idaho.

The classrooms at this school do not look like typical classrooms either. There are no individual desks, only tables for groups of students who work together. Each student has a laptop and uses the internet as a primary search tool for their schoolwork (**Figure 7**). The teacher walks around the classroom, checks in with each group of students and guides and supports the students in their group work. They do not use typical textbooks; there is a bookshelf in the classroom filled with popular science and books related to agriculture and the food system (**Figure 8**).

Figure 7. The classroom environment at the Community School in Ketchum, Idaho.

Figure 8. The classroom library contains a variety of books and resources to help the students with their assignments in the Food Unit.

Each year the students can choose how they want to actively get involved in the food system[3]. The students chose to grow food as a part of their Food Unit because it was a way that they could get involved in their community and learn how food is produced. They grew mainly fast growing, high yielding crops like tomatoes, cucumbers, peppers and pumpkins. The majority of the produce was sold to the community. The rest of the produce was either eaten in the classroom or taken on field trips for snacks. The school does not have kitchen facilities or a food service provider; the students bring their own lunches.

In a previous year the students raised broiler chickens. Through the process of taking an in-depth look into the meat production chain they discovered the social and environmental impacts of meat production. The students had to calculate how many birds they could have on site, examine feed conversion ratios and learn about the regulations associated with small-scale meat production.

The project is not dependent on grants for continuity. Parents donated the initial funding and labor needed to build the greenhouse and raised beds. The operating budget comes

[3] Unlike BHS there is no explicit social goal. Food production is used as a teaching tool.

from the money earned by the students from selling the produce they grew. The program is not meant to prepare students for standardized tests or practical skills; rather it is to facilitate hands on learning and active engagement in their community.

Overall, the program is a manifestation of the school's mission, which is to engage students of diverse talents in an intellectually challenging and supportive school culture. They endeavor to foster in the students self-confidence, integrity, responsibility to their community and environment, and a life-long passion for learning. The purpose of the greenhouse and Food Unit is to teach students that they can grow their own food, to empower the students to participate in the food system and to help the students make real life connections with their math, biology, and civics lessons.

The Sage School in Hailey, Idaho, USA

The Sage School is a small independent school located on the edge of the small town of Hailey, Idaho. It is a relatively new school that opened in 2008 with a vision to help create sustainable and thriving human and ecological communities.

In order to facilitate this vision the school is housed in an old nursery, the back half of which is a 225m^2 greenhouse (**Figure 9**). Inside the greenhouse is a high-tech aquaponic system[4] and a series of raised beds filled with tall tomato plants[5] (**Figure 10**). Each week 10, 14-18 year old students spent 2-4 hours working in the greenhouse where they raise fish and grow basil, arugula, kale, spinach, lettuce, peppers and cucumbers in addition to the main crop of tomatoes. The students have full control over what is grown in the greenhouse. They chose to focus on growing tomatoes because of the high profit margin.

[4] Aquaponics is a food production system that combines aquaculture (raising fish in tanks) and hydroponics (cultivating plants in water). The effluent from the fish is used as the primary nutrient source by the plants. The plants use the excess nutrients and the water is then re-circulated into the fish tanks.

[5] The Sage School Greenhouse video shows (in time-lapse over 8 months) the students and staff working together to set up the raised beds and aquaponics facility.

Figure 9. The sage school in Hailey, Idaho. The left half is the classroom and administration office and the right half is a greenhouse.

Figure 10. Inside the greenhouse at the Sage School in Hailey, Idaho. The tomato plants are on the left and the aquaponics system is on the right.

All produce is sold through the student run business. Whilst students are responsible for the management of the greenhouse, although there is a greenhouse manager whose role is supervision and guidance of the students. The profits earned from the greenhouse go back into the student run business and are also used to fund the annual community service oriented trip that the students take to Ecuador.

The schools director initiated both the school and the greenhouse project. He is an idealist, who "thinks we (as a species and planet) are in trouble, yet this type of education is where we can actually win." The greenhouse project fits perfectly into the school's mission, which is to create an intensive, experiential learning environment for adolescents that is committed to educational excellence and the development of self-awareness through community action, and humanitarian and ecological responsibility.

The focus of the greenhouse project is on social and ecological justice. The goal of the project is to instill science education in the students in an ecologically minded and community-oriented manner. Students spend time caring for something bigger than themselves and in the process they develop a myriad of skills through the experience. In addition to being a means for the students to finance their school trip, the garden serves as a way for them to connect math, physics, chemistry, economics, ethics, environmental science, engineering and community service into one place-based learning project[6,7]. In this respect the greenhouse project is an integral part of the school's curriculum.

The success of the greenhouse project is measured by its financial sustainability. This success helps students to realize their ambitions for the future. Among them is a plan to build a science kitchen and culinary workshop at the school where the students will operate a café, commercial kitchen and get to experiment with value added products.

Shorecliffs Middle School in San Clemente, California, USA

In 2010, a science teacher at Shorecliffs Middle School had a vision of integrating a garden into the lives of her students. Since then approximately 200 7th grade (12-13 years) students have their science classes in the garden at least once per week in the West View Learning Garden.

Shorecliffs Middle School is located just 600 meters from the Pacific Ocean in the quiet beach community of San Clemente, California. Their campus did not have a garden so she wrote and received a grant to fund the implementation of a garden at the school. Consequently a local landscape architect was enlisted to design the 500m^2-terraced garden on the backside of a classroom building (**Figure 11**). The purpose of the garden is to get the students outside of the classroom and into the garden where they can learn about science and the environment through the act of growing vegetables, fruits and native plants.

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[6] The Sage School Growing Ideas

[7] The Sage school uses the Wood River Valley community as a primary resource for learning. The students participate in hand-on projects that provide educational opportunities for the students and valuable contributions to the community.

Figure 11. The West View Learning Garden at Shorecliffs Middle School in San Clemente, California.

Products from the garden are either directly consumed, canned, cooked by the students on site, or used as part of cooking classes and in-class taste tests. In addition to the class time in the garden, the students, their parents and community members are invited to volunteer in the garden on monthly workdays[8]. The teacher who initiated the garden is in charge; she sets the schedule, assigns the tasks, teaches the lessons and is responsible for the maintenance of the garden[9]. Initially grants, the parent teacher association and the school funded the garden; currently the garden is reliant on grants for continuity.

As Shorecliffs Middle School is a public school the teachers must use the curriculum dictated by the state board of education. Consequently, the teachers have little flexibility within their lessons or possibilities to integrate the garden into their lessons. Nevertheless, Jenny finds plenty of ways to teach science lessons in the garden. For example, lessons in genetics are taught in the garden by having the students recreate Mendel's famous pea experiments. Many of the lessons that are taught in the garden are adapted from elementary level school garden lessons to suit the middle school level by the teachers who use the garden. The reason for this is that there are few state approved garden based lesson plans for the secondary school level; the vast majority is for elementary level. Given the lack of flexibility within the curriculum the West View Learning Garden is currently seen as an addendum to the curriculum.

[8] On garden days, the time in the garden includes maintenance tasks (performed by the students) and a lesson given by the teacher.

[9] Unlike in the previously described cases, the students at Shorecliffs Middle School have little to no influence on the design or direction of the garden.

Lectures from a wide variety of topics can be taught in the gardens outdoor classroom equipped with a whiteboard and benches (**Figure 12**). This infrastructure served as an invitation and inspiration for other teachers in the school to use the garden for their lessons. For example, art and writing classes are sometimes taught in the garden. The California beach climate makes it possible to have an outdoor classroom that is useable all year round.

The West View Learning Garden is considered a success by the school because the students participate in the garden at least one lesson per week. The garden is projected to stay in the coming years, more garden-based lessons are being creating and teachers from other subjects are taking their students out of the classroom and into the garden.

Figure 12. The outdoor classroom at Shorecliffs Middle School in San Clemente, California.

The Edible Schoolyard in Berkeley, California, USA

The Edible Schoolyard Berkeley (ESY) is a 4.050 m^2 organic garden and kitchen classroom for the 950 (11-14 years) students at Martin Luther King, Jr. Middle School, which is located in an urban setting in Berkeley, California (**Figure 13**). In addition to serving the students at Martin Luther King, Jr. Middle School, the Edible Schoolyard Berkeley serves as a model program and the headquarters of the Edible Schoolyard Project. It is completely funded by the non-profit organization Edible Schoolyard Project, which provides a network and platform of exchange for other edible schoolyard/school garden projects around the world[10].

[10] The Edible Schoolyard is dissimilar to all the cases in that it is a non-profit organization situated on school grounds with its own funding and staff. The staff facilitates the kitchen and garden for Martin Luther King Jr. Middle School but is not employed by the school.

Figure 13. The Edible Schoolyard at Martin Luther King Jr. Middle School in Berkeley, California. Photo credit, Chloe Carter.

The mission of the Edible Schoolyard Berkeley is to —"teach essential life skills and support academic learning through hands-on classes in a one-acre organic garden and kitchen classroom.[11]" They pursue this mission by inviting the students to be active participants in the whole food cycle. In practical terms, the students learn to work in the garden, and then actively learn how to prepare their produce in the kitchen, followed by a group meal. To complete the cycle, all scraps go back into the garden for compost, which is the main source of fertility for the food grown there. All aspects of the cycle are fully integrated into the 6-8th grade curriculum and school day.

In both the garden and kitchen the students learn how food affects health, the environment and their community. A wide variety of fruits, vegetables and flowers, grains and chickens are grown and raised. While in the garden the students actively participate in growing, harvesting, and composting. All produce is used in the on-site kitchen where the students do the cooking (**Figure 14**). In the kitchen the students learn about culture, history, language, chemistry and geography through the preparation of food. The kitchen looks out onto the garden, which helps the students make the connections between what they experience in the garden with what they learn in the kitchen. The act of sharing a 'homemade' meal together completes the cycle of field to table, which is not only tasty; it is an empowering way to contribute to the development of healthy eating habits.

[11]For more background information on the Edible Schoolyard in Berkley, CA see: Growing a greener world. Episode 108

Figure 14. The Kitchen Classroom at the Edible Schoolyard in Berkley, California. Photo credit, The Wow Haus.

The Edible Schoolyard has been in existence since 1996 and was the initiative an acclaimed chef, restaurateur, activist and author. She took a run-down underutilized piece of land and made connections between food, place and education. After uniting forces with the director of the school, together they paved the way for one of the most famous school gardens in the world. Waters, with support of the local community, generated the $10.000,00 seed money that was used to start the project. Today the site is operated on nearly $1.000.000,00 in annual budget, which comes entirely from grants.

The garden itself does not actually have such a high operational cost and the site is leased for free to the ESY project. The majority of the budget goes to the eight-person full time staff, consisting of the following positions:

- Director
- Administrative coordinator
- Garden manager and teacher
- Two additional garden teachers
- Head chef teacher
- Assistant chef teacher
- One additional chef teacher

The role of the kitchen/garden teachers is to develop lesson plans and teach in the kitchen/garden. When a class from MLK, Jr. Middle School comes into the garden for a lesson the class teacher accompanies them; however ESY teachers provide the lessons in the garden/kitchen. General teaching staff is not expected to teach outside of their window of expertise; however in the garden they are able to highlight the connections between classroom lessons and garden lessons. This helps to bring classroom lessons alive for the

students. Both garden and classroom lessons meet State of California Board of Education standards. In addition to garden lessons, the ESY also provides weekend workdays, evening classes and summer camps. The wider community, parents of MLK Jr. Middle School students and students from other schools are thus able to participate in the Edible Schoolyard through the extended program.

Over the last 19 years, the Edible Schoolyard in Berkley has been able to establish itself as a comprehensive and well-regarded school garden program that serves as an example to similar projects around the world. Through the Edible Schoolyard Project the resources and lessons learned and by ESY and other edible schoolyard projects are freely available to other schools, which serves to inspire and facilitate schools gardens and edible schoolyards. More information and resources can be found at edibleschoolyard.org.

3.2 School garden case studies in the Netherlands

Pantarijn in Wageningen, the Netherlands

Pantarijn is part of a Dutch secondary school community with multiple locations and facilitates a wide variety of educational trajectories. The Green Practical Education program at the Pantarijn in the town of Wageningen is not a typical school garden. The main purpose of the program is to guide students towards positions in which they can find their way in the world. This is done by teaching practical skills in the 'green domain' that will allow them to have a job and live independently.

Participation in the greenhouse and garden program is currently limited to the 125 (12-18 years) practical education students who are supported by one teacher. For the first two years students are exposed to a wide variety of topics, allowing them to choose a direction that they are passionate about. For example, students in this program typically choose to work with small pets, in a flower shop or for a landscaping company.

The space itself combines a classroom, tool room, greenhouse and a variety of outdoor areas and is approximately 2000m^2 (**Figure 15**). There is no on-going plan for the space and it is in a constant state of flux. The classroom is home to several small pets including a tarantula, guinea pigs, doves, frogs, hamsters and lizards and the greenhouse is used as an indoor working space (**Figure 16**). A variety of small demonstration garden plots wrap around the northwest corner of the school's campus and mostly contain ornamentals plants, perennial fruits and some annual vegetables.

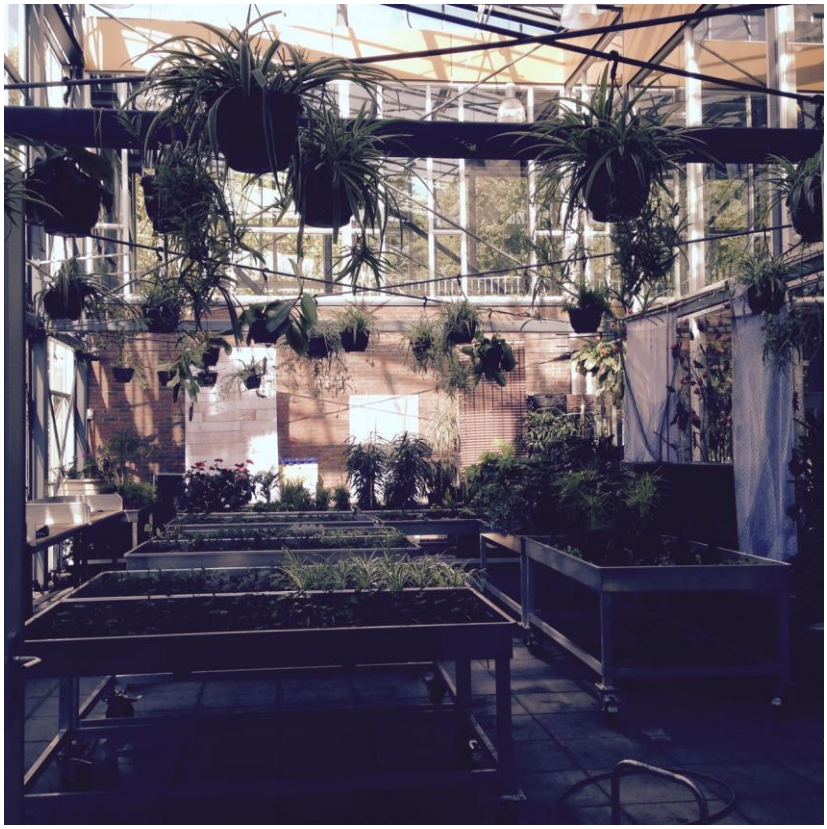

Figure 15. Inside the greenhouse at the practical education department of the Pantarijn in Wageningen.

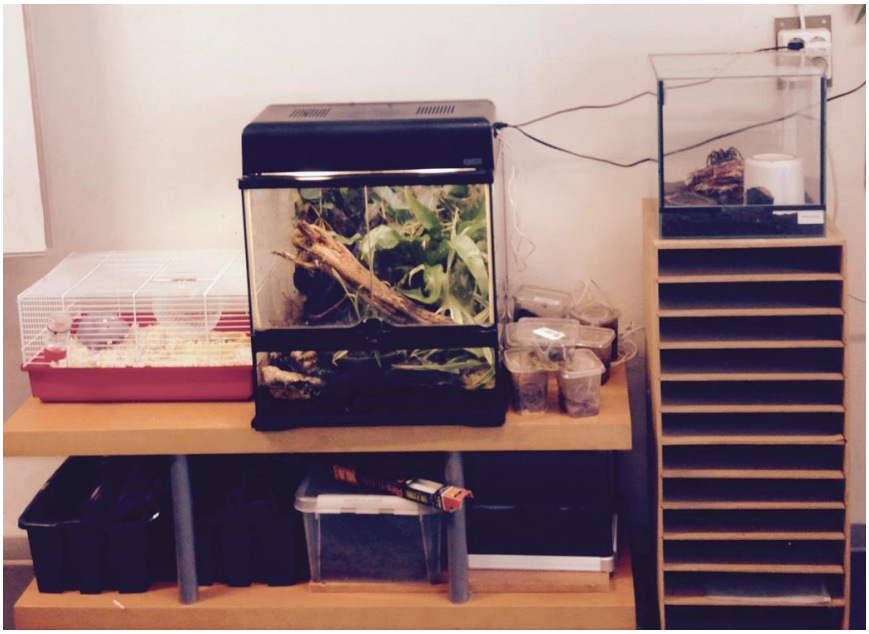

Figure 16. The pets that are kept in the classroom as a part of the practical education department of the Pantarijn in Wageningen.

Depending on the student, they may spend anywhere between 90 minutes to 6 hours per week working in the greenhouse or outdoor gardens. The applied skills taught in the Pantarijn practical education program are student-tailored and based on the chosen direction of the student. There is no fixed curriculum for students and the teacher has complete flexibility with regards to teaching materials or methods. Consequently, the teaching materials come from a wide variety of sources.

For example, the students who choose to train to become a landscaper spend time at the Pantarijn learning about landscaping plants, growing techniques and proper/safe tool use. The outdoor demonstration plots are used as space for the students to practice their skills. For example there is a series of boxwood hedges where the students can learn proper hedge-trimming techniques (**Figure 17**). The curriculum that these students follow has been provided to the Pantarijn by the KPC Group, which is a national educational consultancy agency. The curriculum has limited theory and is mostly based on the development of practical competences.

For the most part the students have control over which plants are grown. The process is teacher guided and together they have the freedom and support to constantly redesign their space or re-invent the purpose of the demonstration plots. The majority of the products are used on site — flowers and ornamentals are used to decorate the school, some of the greens are used to feed the class pets, and some of the food is canned or cooked on site in the schools kitchen. Any remaining products can be sold or taken home by the students. During the school year the responsibility to maintain the spaces is shared between the students and is guided by their teachers. During the summer months the animals go home with the students and the maintenance of the grounds becomes a paid summer job for a few students.

This program at the Pantarijn, which started in 2011 is relatively new and is gaining in popularity each year. The practical education teacher initially started it because he thought gardening was the best way to get his students involved in the 'green world'. According to him, it gives the students the opportunity to connect their head, heart and hands, meet each other and nature in a different context than they normally would in school and develop the skills and competences needed to be productive members of society.

At the moment there is little integration with the rest of the school, however there is a clear desire to further integrate in the future. There is no school food service, despite the fact that the facilities are already on site. Currently the whole project is funded by the school and does not receive any grants. To facilitate future expansions of the project an external would have to be involved because the teachers or school itself cannot receive money on its behalf.

Figure 17. The boxwood hedges where the students learn to properly and safely trim hedges the Pantarijn in Wageningen.

Icthus College in Dronten, the Netherlands

Icthus College is a Christian secondary school that provides LWOO, VMBO, HAVO, and VWO level education. The school is located in Dronten, which is part of the reclaimed land of the Flevopolder in the Netherlands, and the campus is home to the Edutuin (edugarden) (**Figure 18**). This project is a logical manifestation of the school's motto, SamenGroeien (grow together) and logo, a sprouting seed in the ground.

The Edutuin was the initiative of one of the schools directors who had the idea to turn a part of the campus into an educational garden (**Figure 19**). The director approached the school's science teachers with the idea to integrate the campus into the curriculum, which was enthusiastically received. As a result, money from within the schools budget was set aside to create and maintain the garden. Since 2008, approximately 500, 12-18 year old students get to spend a minimum of 90 minutes each week learning and growing together in the 1.500m^2 Edutuin. In addition to this, the students often eat lunch, hangout during breaks, study or do extra work in the garden.

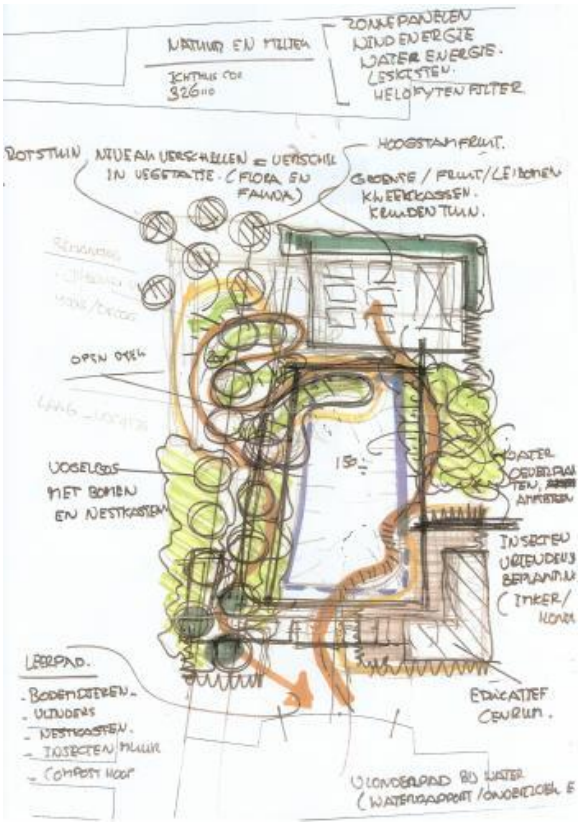

Figure 18. The design of the Edutuin at Icthus College in Dronten. Photo credit: Icthus College.

Figure 19. Students in the Edutuin at Icthus College in Dronten. Photo credit: Icthus College.

The garden contains a large pond, a small greenhouse and several outdoor growing beds filled with annual vegetables. Each year the students get to decide what they want to grow in the garden and the teachers guide these decisions. For example, the students wanted to grow all the ingredients to make 'hutspot' for a school event but this was not feasible because the carrots, onions and potatoes would not be ready to harvest in time for the event. This is seen as an opportunity for the students to learn about seasons, harvest times and planning ahead. The bulk of the produce goes home with the students; however it is sometimes used in cooking classes or the school's canteen.

The students are responsible for the maintenance of the vegetable garden and a hired landscaping company is responsible for the maintenance of the pond, hedges and anything else in the garden that requires the use of machinery. Students are more than welcome to work or spend time in the garden. However in and out of school hours they are required to inform the teachers first; during the summer the garden is closed to the students and is looked after by a few of the teachers.

At the beginning, only science teachers had integrated the garden into their curriculum. Overtime teachers from other subjects such as art and writing have taken their classes into the garden. The garden is now shared with the whole school but the schedule is arranged around the science teachers' use of the garden. The garden lessons are designed by the teachers of Icthus College and meet Dutch department of education standards. As long as students are meeting the set learning goals, the teachers are free to decide on their own methods.

Icthus College has several students that are at the both ends of the IQ spectrum; according to one of the science teachers, the garden is particularly beneficial for these students. The garden gives them an opportunity to learn at their own pace and process social challenges and group dynamics. These students seem to get the most out of the garden and are very passionate about it; some spend as much time as possible in the garden. For this group of students the Edutuin is an integral part of their education at Icthus College, whereas for the rest of the students, it is considered an addendum to the curriculum and a way of enhancing the lessons.

Christelijk Lyceum Apeldoorn in Apeldoorn, the Netherlands

The 2000 m^2 urban agriculture school garden project (schooltuin project stadslandbouw) is located directly opposite Apeldoorn train station (**Figure 20**). The middle school students of the Christlijk Lyceum Apeldoorn run the project. Each week during the growing season, 270 eager 12-13 year old students leave class, hop on their bikes, cycle ten minutes towards the train station, and then arrive at their school garden where they spend an hour working on garden-based assignments for their biology class. Through their work in the garden they learn about plants, insects, tools, responsibility and cooperation.

Figure 20. The urban agriculture school garden project, which is part of the Christelijk Lyceum in Apeldoorn and is located across the street from the Apeldoorn train station.

The urban agriculture school garden was the initiative of the municipality. The site was originally designated for office space but when the plans fell through in 2011 the municipality offered the space to the school for use as a garden. This came at a perfect moment because the school had wanted to start a school garden for the biology students, yet lacked space for it on their campus. The municipality offered to lease the land (for free) to the school for 5 years; local businesses donated the fencing, sheds and tools (**Figure 21**). The school adapted its schedule and hired a dedicated gardening teacher and the other teachers developed their own garden curriculum. The responsibility to maintain the garden is shared amongst the teachers, students, garden-coordinator and community volunteers. In addition to the time the students spend in the garden during school hours, the garden is open every Tuesday evening and is tended by community members.

Figure 21. A flag with all the names of the sponsors in the urban agriculture school garden in Apeldoorn.

The purpose of the garden is multifaceted; it is meant to beautify a public space, to engage the community, to serve as an advertisement for the school and to give the students the opportunity to learn where food comes from and how it is produced in a multisensory manner. The students work together in groups on their own plots. They begin their garden project by making a plan for their plot. Each plot should contain flowers, herbs, and a variety of root and leaf vegetables. The students keep track of their garden assignments in their garden workbook. At the end of the growing season the workbooks are collected and the students are given a mark together as a group. Throughout the season the students harvest from their plots; the majority of the produce goes home with the students and community volunteers. Some students are especially keen to take products home for their parents and/or pets (**Figure 22**). Any additional food is given to the food bank.

Figure 22. An enthusiastic student carrying a sunflower plant from the garden on his bike.

Presently there is no collaboration with the schools food service. However a neighboring restaurant shares a portion of the space and management related tasks. A healthcare company runs the restaurant and is staffed by its clients (people with intellectual and physical disabilities). Both the garden and the restaurant serve as an opportunity for the clients to engage with their community and healthy food. In the process they develop valuable skills like growing food, food preparation and customer service. Other than sharing the garden space there is no direct collaboration between the school and the restaurant.

Over the past three years the urban agriculture school garden has developed into a valued project by the students, teachers and community partners alike. To assess the project, the school carried out an evaluation where they asked the students what they thought about the garden and whether or not the students thought it was valuable for all students of the school to participate in the garden. The results from the students were positive and there is not a clear desire to expand in the future. However this desire is met with the reality of not owning the land and having a lease that expires in 2016. As a result, without a more permanent location or arrangement with the municipality the school is not able to justify the costs of expansion.

Segbroek College in Den Haag, the Netherlands

Segbroek College is just a few blocks from the Dutch coastal dunes in the busy city of The Hague. Behind one of the schools buildings is the Golden Clover (Gouden Klavertje), a 600-m2 school garden. The garden serves multiple functions; it provides an ecological steppingstone for many species, it is an outdoor classroom for Segbroek students, a nice break area for students and teachers, a reception space for school events and a neighborhood meeting spot (**Figure 23**).

Figure 23. View of the Gouden Klavertje at Segbroek College in Den Haag. Photo credit: Joris Koot.

The garden was the initiative of a nature, life and technology (NLT) teacher at Segbroek College. He had recently moved to The Hague for his work and to be close to the sea. He is an avid gardener and thought creating a school garden was a fun and effective way of both getting a garden and giving his students a chance to get outside and learn about ecology with their hands in the dirt. In 2012 a group of fifth year VWO students teamed up with their teacher and a garden designer to try and design a bio-diverse and multifunctional garden in an underutilized corner of the school's campus. To make the garden a reality, he wrote a grant proposal and received €13.000,00. The bulk of the costs went to the creation of the pond in the garden. The garden also receives a €2.000,00 annual budget from the biology department; currently this is sufficient and as a result the garden is not reliant on external grants for continuity.

Currently the garden is growing mostly perennial plants (both edible and ornamental), and some annual vegetables. The pond serves as an ecological stepping-stone and the bug hotel is a refuge for pollinators and other important insects (**Figure 24**). The majority of the harvest is given to the volunteers. Bouquets of flowers from the garden often used as decoration in the teachers' lounge and parsley and other herbs are consumed the lunchroom. As of yet there is no collaboration with the school's food service. This is possible; however this will require someone to take the lead in order to make it happen.

Figure 24. Students and a teacher inspecting the pond in the Gouden Klavertje. Photo credit: Joris Koot.

The maintenance of the garden is primarily the responsibility of the teacher who initiated the garden; however he is supported by the other teachers and community volunteers. Every Friday afternoon the garden is open for volunteers, neighboring residents, and anyone who is interested. During the rest of the week the garden is locked and only the school uses the garden (**Figure 25**). In addition to this, the garden together with the nearby Haagse Beek are in the planning as excursion locations, which are open to the public and made possible through the IVN nature-guides (Instituut voor Milieueducatie en Duurzaamheid).

Figure 25. The gate separating the Gouden Klavertje from the surrounding neighborhood.

According to the teacher interviewed, the purpose of the garden is to let as many people as possible enjoy the garden. Segbroek is a large school with 2300 students of which only a few hundred have their biology lessons in the garden. Currently he and a few other teachers take their students into the garden. Presently the garden is seen as an addendum to the HAVO/VWO biology curriculum; it is a tool to make the standard lessons more fun and tangible for the students. However, more teachers at Segbroek College are starting to make connections to their curricula and are invited to take their students into the garden as well. In addition to further integrate the garden into the education at the school; there is a desire to integrate the garden more into the neighboring community. To facilitate both of further integration, the plan is to create a garden team, (tuin-team) so that more people can be involved in the garden and so that the garden has more to offer to both the school and the community.

4. Analysis

To analyze the data the responses were put into a database, simplified and then coded for analysis. The responses were assessed to look for emerging themes. These themes were subsequently reevaluated in comparison to the literature. Moreover, a new theory on the developmental stages of a school garden was developed. This chapter describes how the gardens compare to each other and explores the themes, which emerged from the data.

4.1 General comparison between school gardens

The first thing that became clear in the analysis of the data was that the school gardens vary greatly in terms of size, number of students, and time spent in the garden. **Figure 26** shows the number of students in relation to the size of the garden. This was conducted to examine whether or not there was a relationship between the two factors. Two groups emerge from this; the American and the Dutch cases. Overall the Dutch school gardens are larger than their American counterparts, with the exception of US5; however there does not initially appear to be a connection between the size of the garden and the number of students.

It is interesting to note that the Dutch school gardens are larger than their American counterparts, even though the cost of both land and labor is higher in the Netherlands. Depending on the design and function of the garden, a larger garden may require more maintenance, which could be a learning opportunity for the students; however it could also lead to higher maintenance costs.

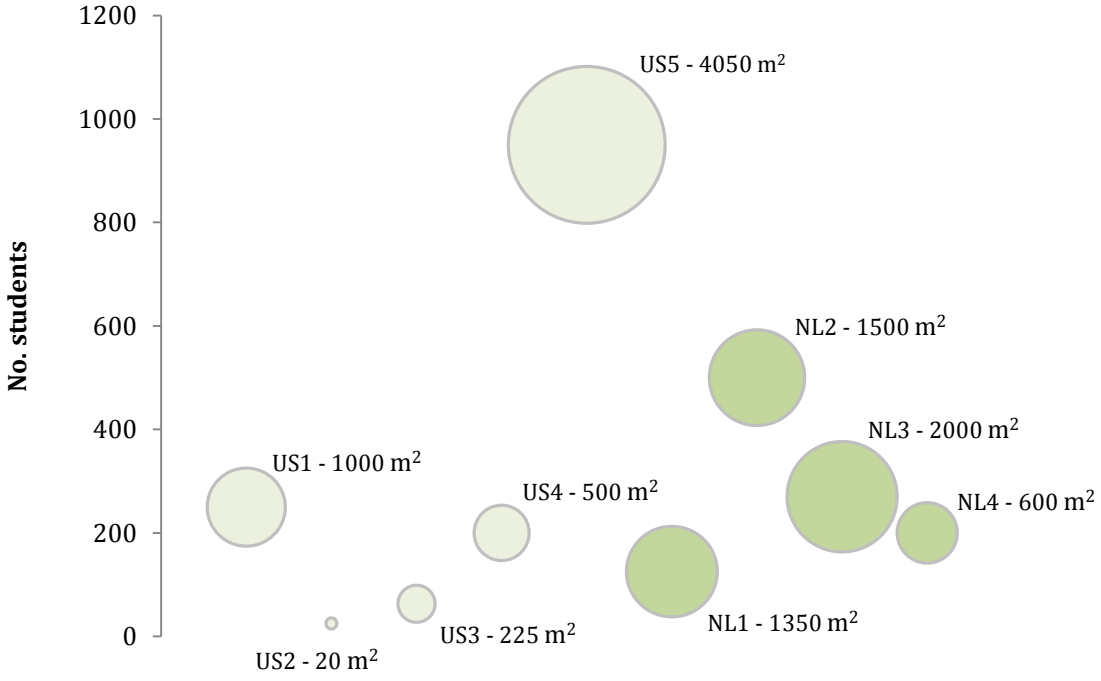

Figure 26. Number of students and garden area.

With regard to the age of the students, the range is wider in the Dutch cases as is shown in **Figure 27**. This could be due to the fact that two of the American case studies are private schools with high tuition costs (US2 & US3) and are in a rural area with a low population. This could be the reason for the low number of students. US2 has a narrow age range even though the school caters to all ages; however the Food Unit is only used in one grade level.

What is clear from this assessment is that a school garden can be successfully integrated into all levels of secondary schools irrespective of the number of students the garden is meant to serve. It is interesting to note that US2 & US3, have a very low student teacher ratio and the garden is fully integrated in their curriculum.

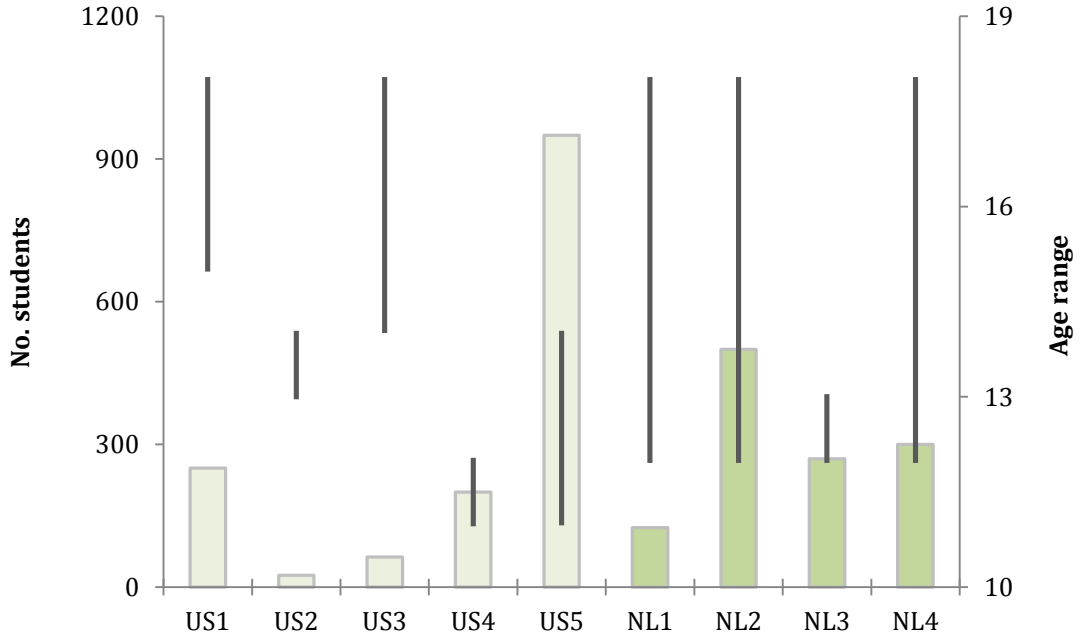

Figure 27. Number of students and age range.

Figure 28 depicts the average area per student as compared to the time spent in the garden. The question behind this comparison was whether or not the students would spend more time in the garden if the garden were bigger. This is not the case; however it is interesting to note that in more than half of the cases the students spend between one to two hours except in the cases where the garden is viewed as an integral part of the curriculum. This is logical in that, if the garden is as an integral part of the curriculum more time can be devoted to it. In contrast, if the garden is an addendum to the curriculum there may not be enough flexibility within the curriculum to justify more time spent in the garden.

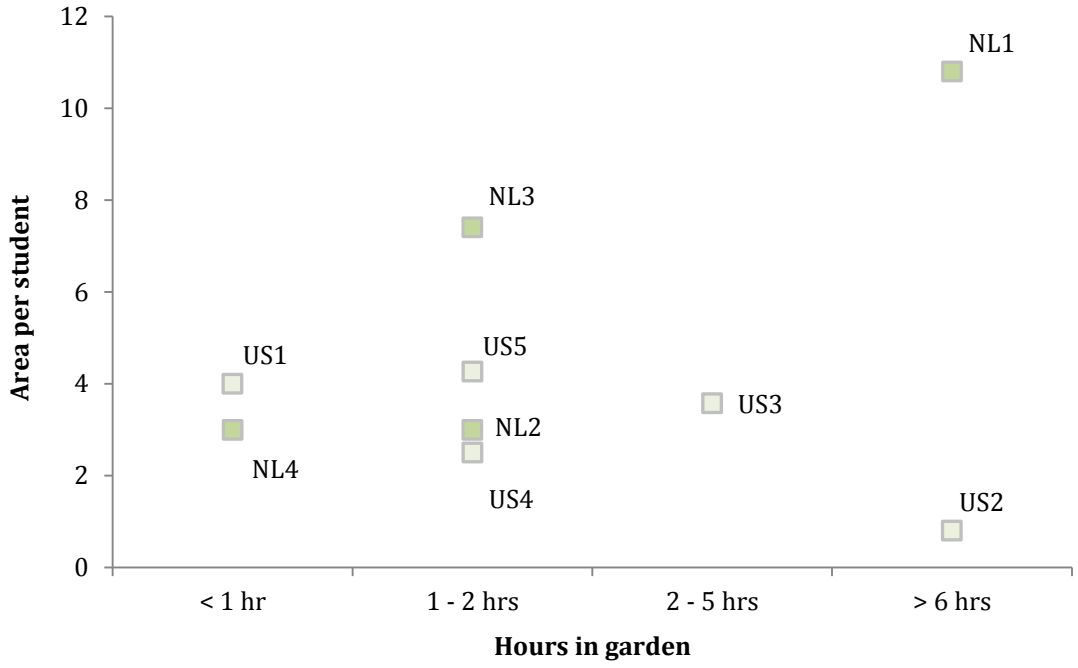

Figure 28. Average area per student and time spent in garden (hours per week).

4.2 School gardens as communities of practice

To evaluate and analyze how school gardens are integrated into secondary schools it is useful to first return to organizational theory and then to the concept of "communities of practice". According to Richard Daft, organizations are social entities that are goal directed, are designed as deliberately structured and coordinated activity systems, and are linked to the external environment (Daft, 1998). By this definition school gardens are organizations because they are a group of people (primarily students and teachers) working together to achieve their goals by using gardening and food production as a tool for learning. They are deliberately structured and coordinated systems in that they are an intentionally chosen element of a school (not evolving by chance) and they are a direct link between the classroom, school campus and surrounding community.

From here the school garden can be further described as a community of practice. A community of practice differs from an organization in that, the emphasis is on what is

learned rather than on what it produced, who is a member, or in which network the organization exists (Wenger, 1998). The concept of a community garden as a community of practice is not new; it has been used to describe community gardens (Kransy, 2009). However this concept has (to the researcher's knowledge) not been used to describe school gardens in secondary schools. Etienne Wenger defines a community of practice along three dimensions:

- **What it is about** – its *joint enterprise* as understood and continually renegotiated by its members.
- **How it functions -** mutual engagement that bind members together into a social entity.
- **What capability it has produced** – the *shared repertoire* of communal resources (routines, sensibilities, artifacts, vocabulary, styles, etc.) that members have developed over time (Wenger, 1998).

In the literature on communities of practice, Smith explores ways in which communities of practice emerge within schools by prioritizing learning activities that are planned by students as well as teachers (Smith, 2003). One key element that is needed is the link between the school and the external community. This link was particularly evident in the Sage School's approach to their school garden. The teachers do not dictate the activities of the school garden. The teachers facilitate the students in learning whatever they need to learn to achieve their goal of operating a profitable food production business through their school. For example the students at the Sage School wanted to grow tomatoes and build an aquaponics set-up because of their high market value of the products. To accomplish this, the teachers helped students calculate what they would need and walked the students through the process of building and maintaining the system. All the products of this business are sold directly to the local community thus linking the students directly to the individual consumers and associated organizations in their community.

The challenges and opportunities for school gardens to facilitate a community of practice lie primarily in how the school garden is practically and structurally integrated into the school. For example, if the purpose of the garden is not well defined and communicated the students may not feel ownership of the garden and may lack a sense of mutual engagement. The design and implementation of shared repertoire such as routines artifacts and vocabulary provides opportunities for this. For example, when students start their lesson in the Edible Schoolyard they begin by reviewing the lesson for the day in the Ramada, which serves as the outdoor classroom (**Figure 29**). This physical space gives the students the feel of a classroom and lets them know that this is 'learning time'. The daily lessons are similarly structured but involve variety in the focus of the lesson and the task that are carried out by the students. The concept of shared repertoire in the form of vocabulary is well illustrated in their use of the acronym FBI (**Figure 30**). This stands for fungi, bacteria and invertebrates, which are the decomposers needed to break down organic material in a compost pile. This easy to remember acronym connects to a concept that is present in all kitchen and garden lessons because it is the key place in the garden where the food cycle is completed. A space for compost was present in all school gardens visited however in several cases the learning opportunities from the compost were not fully exploited.

Figure 29. The outdoor classroom, which is referred to as the Ramada is where all the classes begin in the Edible Schoolyard in Berkeley, California.

Figure 30. Compost Row at the Edible Schoolyard in Berkley; an example of shared vocabulary.

When looking at school gardens as a means to facilitate learning in a community of practice, it is useful to examine what the intended learning outcome is and how the cases compare in relation to each other. The strength of the focus on practical skills and theoretical knowledge is illustrated in **Figure 31**. An example of using the garden to teach practical skills is teaching the students to grow food or use tools safely. Whereas using the garden to teach math, chemistry or biology is an example of using the garden to teach theoretical knowledge.

The US cases have a stronger focus on both practical skills and theoretical knowledge. This could be related to how the purpose and activities are communicated, e.g. learning goals are more explicitly stated in the US cases. Additionally, there are more resources available to the US cases. The Edible Schoolyard Project has been instrumental in developing a platform for schools to share resources and ideas with each other, making it easier for schools to link the garden to existing state mandated learning goals. Moreover, it is common for US schools to have cooking facilities and school food service; whereas in the Netherlands this is not common. This difference could make it easier for the US cases to connect the garden with onsite cooking facilities with a focus on practical cooking skills.

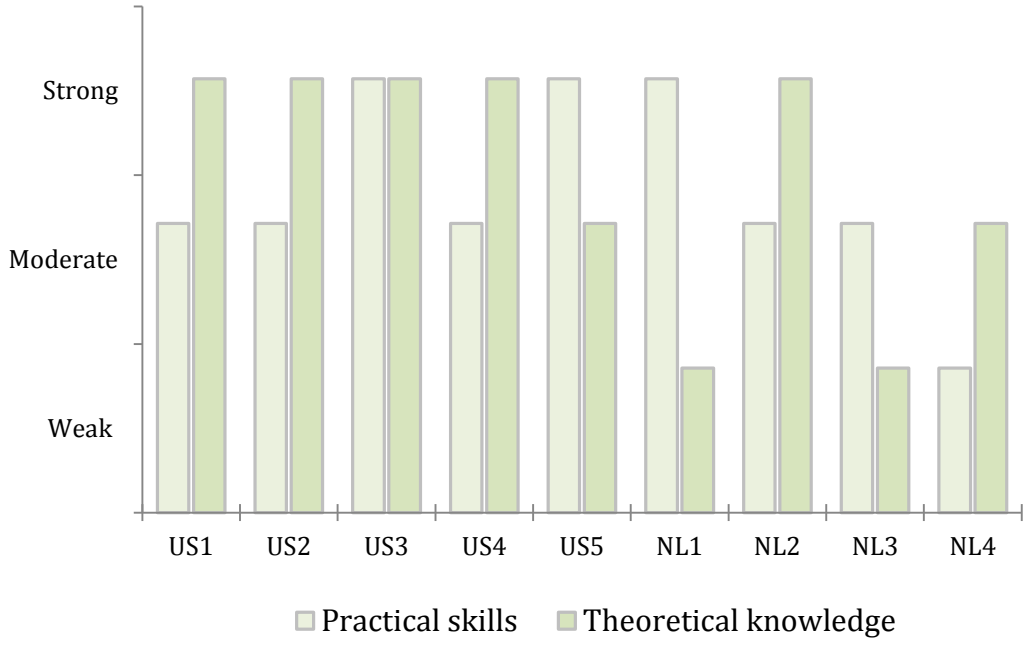

Figure 31. Strength of focus on practical skills and theoretical knowledge.

4.3 School gardens as a microcosm of civic ecology

A school garden in secondary school gives students the opportunity to combine local and global social and environmental issues in a results oriented (in contrast to problem-based) perspective in a microcosm of civic ecology. Civic ecology refers to small-scale, self-organized stewardship practices that integrate environmental and social values in cities and other peopled landscapes; this term also reflects the linked social and ecological systems implications of urban participatory environmental restoration and management initiatives (Kransy, 2009). The school garden is an element in a school that provides opportunities for self-organized stewardship practices that integrate educational goals with environmental and social values of both the school and external community. These learning opportunities are different from traditional theory based learning in a classroom setting; often the emphasis is on the development of skills and competences.

In all the cases studied the primary goal of the gardens is learning. However the purposes of the garden vary and the extent to which the gardens are linked to the community also varies. **Figure 32** evaluates the strength of the links to both the internal (the school) and external community (the community where the school is located). From this it is evident that the links to both the internal and external community are stronger in the US cases. This could be related to the developmental stage of the garden and to the stated purpose of the garden. For example, the links to the internal and external community are strong at US3 and US5. At US3, the link to the community is an integral focus of both the school and the greenhouse project. As a result, a significant amount of time and energy is spent fostering the links to the community. US5 has been in existence for 16 years and has had the time and resources necessary to develop the links to the community. In contrast, NL1 is a relatively new program and has not yet had the time to develop its links with either the internal or external community. Case NL2 has a strong link to the external community because they are dependent on the links with the municipality and the healthcare company with whom they share the garden.

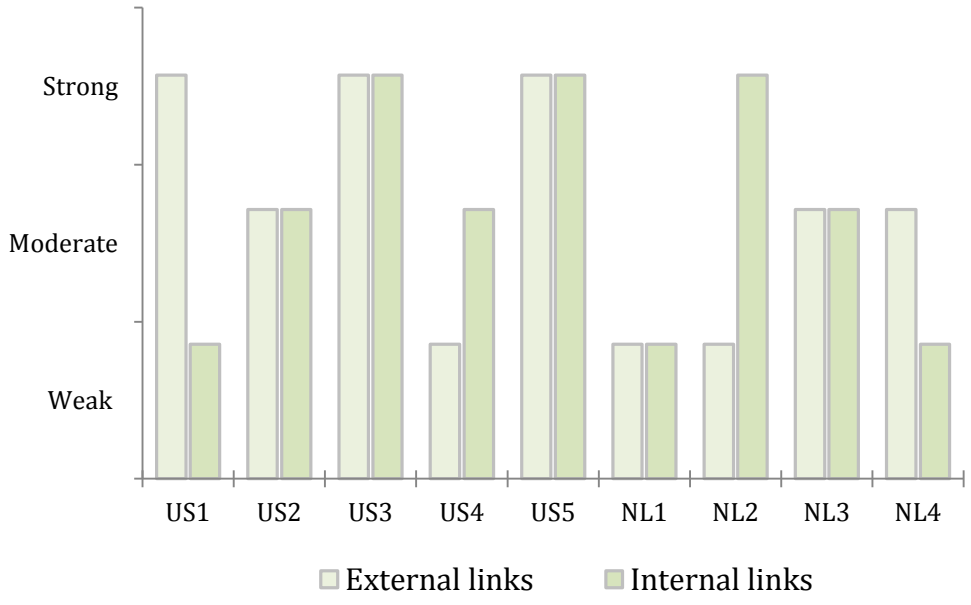

Figure 32. Strength of the links to the internal and external community.

When asked what the purpose of the garden is, the responses vary greatly. The focus is broadly related to civic ecology however they do not explicitly use this term (except for US3). Listed below are the purposes of the school gardens, as stated by the key informants:

- To be good neighbors by beautifying a space; to rehabilitate the land in the context of an environmental science class,
- To make real life connections to the math, biology and civics lessons by empowering students to grow their own food,
- To stimulate students interest in science,
- To get students outside into the fresh air where they can learn through the act of growing vegetables and native plants,
- To teach essential life skills and support academic learning through hands-on classes in a one-acre organic garden and kitchen classroom,
- To show students where they fit in the world; to develop skills needed to be employable and be able to live independently,
- To experience, feel, try, taste, smell; to learn with all the senses,
- To learn to work together; to learn where food comes from and how food is produced.

This link to the external community through food production was evident in all the cases studied but varied in the ways they linked. **Table 5** identifies the links to the external community by listing where the garden products go and whether or not the garden is open to the public. The potential effect or impact on the community could vary greatly depending on what the function of the school garden is and to what extent the school garden is linked to the external community. For example, if the function of the garden is to provide space for students to learn about food production and the products of the garden are donated to a local food bank, the school garden could have a direct effect on the food security of a local community.

In a different scenario, if the purpose of the school garden is to teach students the skills needed to live independently then the garden can also serve as a means to facilitate the development of productive members of society. In this scenario, neither the garden itself or the products does not directly impact the community, however the students themselves would have an impact on the community later in life.

A school garden could have the function of being an ecological stepping stone, thus serving the community by providing ecosystem services and learning opportunities for the students and the community. This function could play a prominent role in the curriculum depending on which subject it is integrated into. For example, if a school garden is located in a densely populated area it could serve as a vital stepping-stone for wildlife. This could be an opportunity for students to learn about ecology, urban planning and ecosystem services, while at the same time facilitating those functions in the surrounding environment.

In all of these potential scenarios there are both challenges and opportunities. One primary challenge is to make explicit what the intention and/or function of the school garden is. In regards to civic ecology the challenge is to use the school garden as a physical space, which provides learning opportunities that contribute to both the school and the local social and

ecological environment. The specific opportunities will depend on the extent to which the school supports the garden and what the particular needs of the school and local community are. The challenges and opportunities of school gardens are expanded upon further in the following section.

The aforementioned links to the local social and ecological systems are present in all cases, yet in some cases the purposes of the garden is to use the tool to achieve state mandated learning goals and in other cases the purpose is broader and encompasses civic ecology. **Figure 33** shows the strength of the focus on garden based learning and civic ecology.

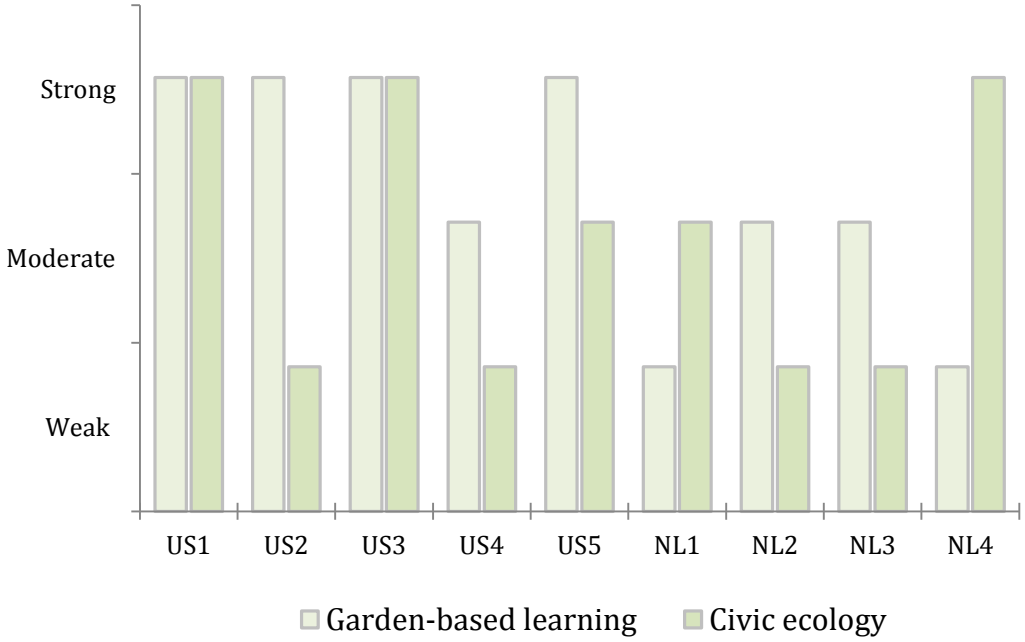

Figure 33. The strength of the focus on garden based learning and civic ecology.

There is no clear distinction or grouping between the cases, however it is clear that there is a moderate to strong focus on civic ecology in half of the cases. This indicates that the school gardens are able to facilitate more than just garden based learning. The stated purposes and goals of the garden go beyond the teaching of both practical skills and theoretical knowledge and include a focus on both social and ecological stewardship practices.

Table 5. Connections between school gardens and the wider community.

Case	Where does the food go?	Is the garden open to public?	Link with local community
US1	Eaten by students & volunteers; donated to church	Yes	In the garden
US2	Sold & eaten by students at school	No	Through sales
US3	Sold through student run business	No	Through sales
US4	Eaten by students at school	No; except for monthly volunteer work days	In the garden
US5	Used in kitchen and eaten by students at school	Yes; not to work or eat from, more like a park for local residents; summer school	Local residents & media
NL1	Eaten at school, taken home or sold	No	External internships
NL2	Eaten at school, taken home or sold	No	NA
NL3	Taken home or donated to food bank	No; except for weekly volunteer work days	In the garden; space shared with restaurant & community garden
NL4	Given to volunteers	No; except for weekly volunteer work days	In the garden

4.4 Stages of development of a secondary school garden

School gardens (in secondary schools) are not a static element of a school. They are constantly shifting and changing both in terms of social and physical elements. The nine school gardens assessed have been in existence between 2-19 years. In analyzing the responses from the interview questions it emerged that a school garden in its initial stages is quite different than the school gardens that had been in existence for multiple years. The differences in the gardens in terms of physical elements such as size and location are not explained by the developmental stage. However the difference in terms of strategic elements such as goals, challenges and opportunities can be explained by the developmental stage.

To assess these differences with the intention of developing a theory on their developmental stages the case studies were sorted by years in practice, what their goals were, what their challenges/opportunities were, and to what extent they were integrated into the school in terms of being an integral part of the school or an addendum. Moreover, they were grouped for similarity. Three groups emerged and were named the *connection*, *immersion* and *dispersion* stages (**Figure 34**).

Figure 34. The stages of development of a school garden.

Table 6 shows the case studies in this thesis listed by years in practice and developmental stage. **Table 7** & **Table 8** lists the three distinct stages of a school garden along with the corresponding goals, challenges and opportunities. The following section gives examples of school gardens in each stage of development.

Table 6. School gardens by stage of development and garden age

Case	School	Stage	Years
NL4	Segbroek College	Connection	2
NL3	Chr. Lyceum Apeldoorn	Connection	3
US1	Boise High School	Connection	3
NL1	Pantarijn	Connection/Immersion	3
US4	Shorecliffs Middle School	Immersion	4
US2	Community School	Immersion	4
NL2	Ichtus College Dronten	Immersion	6
US3	Sage School	Immersion/Dispersion	6
US5	Martin Luther King Jr. Middle School	Dispersion	19

Table 7. Opportunities faced by school gardens through each stage of development – connection, immersion and dispersion.

Connection	Immersion	Dispersion
Short term goals	Short, medium & long term goals; forward thinking & ideas for the future	Initial goals realized; expanding impact
Link garden to curriculum; no fixed garden lessons	Desire to involve more subjects & teachers Creating more lesson plans	Share information with other schools; model program
Establish garden; Improve space	Expand the garden; extend reach within school (cooking/meals)	Integration with cooking &/or meal service
Facilitate skills development; food production, landscaping	Facilitate empowerment & skills development	Idea hub; expansion into new ventures/product development
Secure funding or land (longer lease); Maintain volunteer labor	Stable funding & labor	Stable funding; paid staff
Get kids outside; sensory learning	Integrate with outside community	Deepen relation with school and community

Table 8. Challenges faced by school gardens through each stage of development – connection, immersion and dispersion.

Connection	Immersion	Dispersion
Land tenure	Optimizing inputs	Management of materials, land, budgets, & communication
Integrating garden into curricula	Quantifying the outputs	School wide involvement
Flexibility within curriculum (scheduling)	Gaining insight into future direction	Institutional norms
Steady labor	Deepen integration into school	Risks with new ventures
Sufficient gardening knowledge	Additional training and resources	Impact studies
Securing funding	Funding for expansion	Funding for personnel

Characterization and examples of school gardens in each developmental stage

Connection

The *connection* stage is characterized by short-term goals[12], establishing the links with the curriculum in one or multiple subjects, developing the garden and securing the necessary funding or land tenure so that the garden can be established into a lasting school program. The primary goals of the school garden project of the Christelijk Lyceum in Apeldoorn are to improve the space, provide advertising for the school and to get the students out of the classroom and into the fresh air where they are learning with all their senses. They only have short-term lease (5 year) on the land, which makes thinking past the immediate season a challenge. It is possible that they would be able to stay however they are not likely to invest more energy to further expand the project because it may not continue past the current lease. This reality makes moving from the *connection* to *immersion* stage unlikely unless they were to secure land tenure.

It is assumed that there is an additional stage preceding the connection phase; this start-up stage would be the initial stage where a school garden is just being formed. Depending on whether or not the students participate in this process, this stage could be combined with the *connection* stage. For example, the students at Segbroek College, Sage school, and Community School participated in the design and implementation of their school gardens as part of their schoolwork. Therefore in these aforementioned cases the start-up stage and the *connection* stage could be combined. In contrast, landscape architects designed the gardens of Icthus College and Shorecliffs Middle School; the students were only brought into the process once the garden existed in its physical form. In these cases the start-up stage and the *connection* stages should be seen as separate stages. The start-up stage is not further explored in this thesis, as there were no case studies in this stage.

Segbroek College is a large school with a small garden. Currently there is only one teacher responsible for managing the garden. Many of the school's teachers and students still are not aware that the garden is available for their use, even though it is located on the schools campus. The current goal is to let more people know about it and to give them an opportunity to use the space as well. Presently this teacher sees the garden more as his garden rather than the schools garden. This could likely change when more teachers start using it with their students. This teacher has the longer-term goal for the garden to be more integrated within the surrounding community, however the current needs of the garden and teaching duties leave little time to expand the reach. This is also likely to evolve as the garden becomes more established and the project leaders can focus more attention on community outreach. As a school garden becomes more integrated into the school the inputs such as time and money can be used more optimally, this can lead to an opportunity to extend the focus to deepen the integration within the school or community. This optimal use of resources is a key difference in defining whether a school garden is in the *connection* or *immersion* stage.

[12] Long-term goals may also be present but were either not explicitly mentioned or were overshadowed by the short-term goals.

Immersion

The *immersion* stage is characterized by school gardens that are thoroughly integrated into the school; the garden is already established and the time and financial inputs are stable and used optimally. This then leaves time to focus on a broader set of goals. Goals can include the connection of cooking and meal service (using garden produce) or strengthening the bond between the school and the community through the act of participating in the garden or sharing food with the community. In the *immersion* stage the people managing the school garden may also focus on quantifying the outputs (products and/or services). This information may give the school insights into how the school garden is contributing to the school and can serve as a justification for additional training and resources.

The school garden at Icthus College has been in existence since 2008. When the garden was started it was only used in the science classes. Over time teachers of a variety of subjects, such as art and writing, started utilizing the garden in their classes. The teachers of the school have developed their own lesson plans to be used in combination with the garden. The site for the garden is secure because it is on the school's campus. The funding required for maintenance of the garden is minimal and consists of the landscaping company trimming the hedges and costs of seeds and supplies. The students and teachers carry out the labor required for the maintenance of the garden. There are no plans for expansion of the garden however there is a goal to use the garden more and to use more of the garden's products on the school's cooking facilities and for school events.

The Community School's garden/greenhouse is a part of the 8th grade year's Food Unit and is reinvented by the students on an annual basis. The reinvention presents endless possibilities, however it also presents a challenge to move to the *extension* stage. The re-inventive character could create a loop in the *immersion* stage. Each year the students will start the year learning about relevant topics in agriculture or food policy, they then choose a project for the year that gives them the ability to dive deeper into the topic and make a tangible contribution to their community. This may be the production of egg laying or broiler chickens to facilitate learning about animal agriculture and its accompanying societal and environmental issues. The following year the students may choose to grow vegetables in their greenhouse and focus on the broader issues surrounding local agriculture and the social and environmental impacts of a plant based diet. There is no standard curriculum and no intention to make one. The teachers come up with a general plan each year and together the students and teachers fill in the details along the way. Which ever direction they choose to go, whether it be plant or animal production, there is a clear desire to facilitate empowerment and skills development amongst the students; they are then given a direct and hands-on opportunity to use these skills in the context of their school and external community.

Dispersion

School gardens in the *dispersion* stage have already realized their initial goals and are an integral part of their school. At this point the focus can shift towards extending the impacts of the garden. This could happen by becoming a model school, meaning that the school garden serves as an example for other school gardens and may share teaching materials and guidance to other schools. In the *dispersion* stage, schools can also decide to expand into new ventures and products (to develop new sources of income).

The Greenhouse is a fully integrated element within the Sage School. They have realized their initial goals and are now expanding the impact of their goals. To illustrate this, they plan on using the profits from their current and planned operations to subsidize the costs of their annual international volunteer project, as well as to provide tuition assistance for local students of low-income families who wish to attend the Sage School. They also have a plan to build a kitchen chemistry lab on site where the students will use products grown by students to learn about cooking and chemistry in a hands-on manner. In addition to this, the kitchen chemistry lab will serve as a test kitchen where the students can develop value-added products that can be sold to the local community at a premium price thus increasing the revenue potential of their products. This extends the learning goals from agriculture and culinary skills to marketing, economics and social entrepreneurship.

The Edible Schoolyard has been in existence for 19 years. Over the years they have had the opportunity to connect, immerse and extend their reach. They serve as a model program for school garden projects around the world by sharing their resources so that other schools can accelerate faster. They do this by having a non-profit project called the Edible Schoolyard Project Network that connects educators from around the world creating a network and platform to share edible education curricula (The Edible Schoolyard, 2015).

They have a fully integrated program meaning that all school's students pass through the Edible Schoolyard (garden and kitchen) program during their time at MLK Jr. Middle School. The students experience the entire food cycle; from food in the field, to ingredients in the kitchen, food on the table and scraps to the compost bin and back into new vegetables. They have standard lesson plans that fit within the state approved curriculum and they have dedicated teachers for the garden.

5. Discussion and reflection

5.1 Discussion

Despite the fact that the topic of school gardens has received much attention in the scientific literature, little is known about them in the context of secondary education. It is unknown whether or not similar studies have been carried out. This research seeks to add to the body of knowledge on this topic and serve as a starting point for future research or applications.

The findings in this research are not statistically relevant. The number of secondary school gardens in relation to the number of secondary schools is unknown. Therefore, it is not possible to say to what extent school gardens are being used as a teaching tool in secondary education. This research only examined the cases in the American and Dutch context. It could have been useful to examine it in a wider geographical setting so as to add to the findings.

A limited number of case studies were examined, which did provide valuable insight into how schools are implementing garden based learning and civic ecology. A theory on the development of school gardens was postulated based on the input from examples of school gardens in different stages of development. This provided a general picture of the characteristics of each stage, however it lacks validation. The key informants were interviewed only once, which sheds light only on those examples at that particular time and not how they evolve over time. This theory was extrapolated based on the compilation of data from the cases studied. To test this theory, the cases would need to be examined over a longer period of time.

The analysis of the case studies as a community of practice and as a microcosm of civic ecology was done using a limited number of responses to the questions asked and does not reflect the projects as a whole. This examination also required relative value judgments and potential biased categorizations. Given the inductive approach it should be noted that other researchers could have approached the data from a different perspective and seen other trends or developed other theories from the data collected.

The interviews of the Dutch key informants were conducted in varying degrees of Dutch, however the researcher only has a limited working proficiency of Dutch and several of the key informants were not comfortable doing the interview in English. Consequently there is a chance of misunderstandings and perhaps a biased understanding of the American examples. This could have been mitigated by additional communication between the researcher and the key informant of the Dutch examples, however this did not happen.

This research provides insights and potential practical applications in the fields of educational policy, curriculum development, school campus design, experiential education pedagogy and didactics. The examples of successfully integrated school gardens could serve as an inspiration for aspiring schools or teachers and the insights gained through this research to be used to guide such projects. The challenge herein lies in how to communicate the findings to the relevant parties.

5.2 Reflection

This is an emerging field and at the moment little is known about it. Given the constraints and the chosen methodology for this research this is a first step into researching the integration of school gardens in secondary schools. After taking that first step it is possible to reflect on the commonalities/contrasts between the cases and the emerging themes. This research attempts to do that. From an analysis of what is currently working in these schools it is possible to infer this information into a list of recommendations that may be of use as a reflection tool for current and prospective school garden projects.

This research was my first time conducting interviews for research purposes. In retrospect it may have been a good idea to have the questions reviewed by someone who specializes in interview techniques. However, the questions were listed in my proposal and were reviewed by my supervisors. I got positive feedback from both of them as well as the audience at my proposal presentation. During the fieldwork portion of this research I visited the nine schools. The key informants were interviewed during regular school hours, either during class time or during a break. This was practical but led to distractions. The interviews were often interrupted by students or had to be recorded in separate time slots.

Upon completion of the first few interviews, I began to see how the questions could have been worded differently or how I could have gotten more useful information from the interviews. For example, at each school I met with one or two teachers. They often said that other teachers of other subjects also use the garden. In my standardized interviews I did not ask which subjects were taught in the garden. This information did emerge through the course of the conversations with the teachers but it was not formally a part of my questioning. In addition to this I was only able to get the perspective of one or two key informants this may not have provided a complete insight into how the garden is integrated into secondary schools.

The questions in the structural and ideological sections often led to vague answers. This made it a challenge to evenly compare the cases. Several of the school garden projects were in their first years and had not fully integrated into their school yet. This meant that the picture that emerged from my interview was limited.

During my visits to the school I only recorded the question and answer portions. At nearly all schools I was given a tour of the garden and was told the story of their garden from their perspective. This provided wonderful story telling material however it was not recorded and is not reflected in the dataset from this research. That being said, the observational material was used in this research.

I took many pictures during my visits to the school gardens, however I was asked multiple times to not use photos. Consequently, the students are absent from the photos except where permission was granted. This presented a challenge visualizing how the students use the gardens or how the students experience the garden. For this reason the photos taken were not a part of the analysis but are added for illustrative purposes.

After having completed my research and reviewing the research objectives it became clear that given this methodology, time frame and budget, it was not really possible to determine the factors of success or failure of a school garden project as I had originally intended. In general I could only say what works at these case studies. Although the case studies

provided rich in-depth findings additional case studies research is needed to determine success factors.

This would need to include cases that failed; history of the project would need to be thoroughly unpacked so that factors that contributed to their failure could be identified. As a result the focus of this research shifted to examining the gardens from an inductive approach, which led to the development of a theory on the stages of development typical for a school garden. This approach was challenging due to a lack of a clear plan for the analysis phase. However it proved to be valuable/useful to investigate a phenomenon about which little is known.

6. Conclusions and recommendations

6.1 Conclusions

- On a practical level, school gardens that are successfully integrated into secondary schools:
  - Come in a wide variety of shapes and sizes;
  - Produce food which can be consumed by students, or processed on site thus increasing the educational potential of the garden;
  - Provide year round learning and skill training opportunities.

- On a structural level, school gardens that are successfully integrated into secondary schools:
  - Can be used to teach a variety of subjects at all levels of secondary schools regardless of school type, location or public/private status;
  - Need additional curricula and teacher training;
  - Are funded by a variety of sources, including the school, grants and donations.

- On an ideological level, school gardens that are successfully integrated into secondary schools:
  - Are initiated by school employees (teachers or administrators) who have a clear vision and take the initiative to establish a school garden;
  - Provide a space for the school to physically manifest its mission;
  - Provide a space for students to be active participants in their education;
  - Can be exploited to teach practical skills and theoretical knowledge regardless of whether it is viewed as an addendum to or integral part of the curriculum.

- School gardens in secondary schools can facilitate learning in communities of practice.

- School gardens are a microcosm of civic ecology; they give students the opportunity to participate in and contribute to their communities in a results-oriented hands-on manner that connects local and global social and ecological issues.

- The needs, goals, opportunities and challenges of a school garden are different and evolve depending on which stage of development the school garden is in.

6.2 Recommendations

Recommendations for current and prospective school gardens in secondary schools

- Involve students in the design and implementation process. This can provide additional learning opportunities and may help to foster a shared sense of ownership of the garden.

- A school garden does not have to be large. Use existing space at the school, this can take many forms and is not limited to conventional notions of what a garden looks like. Exploit the educational opportunities of small spaces before moving to large spaces. This can keep the maintenance required to a minimum.

- Make use of existing infrastructure in schools, i.e. cooking facilities and storage.

- Securing land tenure and basic funding for supplies and labor is essential for the start-up and sustainability of a school garden.

- Complete the food cycle; grow food that the students can prepare, eat and compost. The connection of food production and food processing may strengthen the learning outcomes for students.

- Have a space in the garden that can be used as an outdoor classroom. This communicates to the students that the space is intended for learning. The space may also be used for school events.

- Create shared vocabulary that is catchy and helps students remember concepts learned in the garden. This may be easiest to do for tasks that are routinely carried out, play an essential role in the garden, and connect to theoretical knowledge; e.g. composting.

- Adapt school schedule (if necessary) to allow for 90+ minute sessions in the garden throughout the school year. Blocks of time less than 90 minutes may not be an efficient use of time to spend in the garden if it should include both a lesson and a physical task such as garden maintenance.

- Facilitate participation in the school garden during the summer holiday. There may be students who would like to work in the garden during their summer holiday and this may reduce the need for garden maintenance during peak growth season.

- Explore social and ecological connections to both the internal and external community. This presents learning opportunities in a wide variety of topics.

- Keep records and make evaluations; this can help when applying for funding, optimizing the gardens' inputs and reflecting on achievements and future goals.

Potential future research

There are still many unknowns about school gardens in secondary schools. It is recommended that research continues, as it is an emerging field that offers potential for enhanced educational and professional development. Professionals and students of various educational levels and trajectories could conduct this research[13].

Additional research is needed to:

- Determine the success factors of school gardens;
- Determine effects of school gardens on secondary school students;
- Identify schools that have a desire to implement a school garden;
- Examine the link between school gardens and transformational learning;
- Determine feasibility for the funding and development of a model program in the Netherlands.

Potential future educational and commercial applications

Curriculum development and teacher training

Several of the key informants of this research indicated a need for garden–based teaching materials for the secondary school level and teacher training on how to utilize the garden to teach a wide variety of skills. This need was more pronounced in the Netherlands. The majority of the currently available resources is tailored to American schools and is in English. The development of relevant resources for Dutch schools would require that someone or a team of people with backgrounds in education, curriculum development and gardening, to develop curricula and training opportunities for teachers and administrators[14].

Consulting

School gardens in all education levels are becoming increasingly popular in the United States; often the initiative to start a school garden comes from a teacher or school administrator. It may be useful to explore whether or not there is a desire for consulting/advice services at schools or various policy levels.

[13] Upon completion of my M.Sc. I plan to pursue these additional research topics.

[14] The Educatief en Eetbaar Groen project from Brabant is an example of this however it is unclear in what stage or to what extent this has been realized.

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