Elicitation of Teacher Beliefs Related to School Garden Experiences

by

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A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
August 7, 2021

Keywords: school gardens, elicitation, outdoor, TAM2

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Abstract

This elicitation study focused on teacher beliefs about the school garden and how that relates to school garden experiences. The Extended Technology Acceptance Model (Venkatesh & Davis, 2000) was used as a theoretical model through which the survey was designed, and the findings were discussed. The Extended Technology Acceptance Model (TAM2) was created to better understand the adoption and usage of new technology. In this study, school gardens take the place of the new technology, and the survey was created to better understand the seven variables (experience, subjective norm, image, job relevance, output quality, result demonstrability, and voluntariness) that influence the perceived usefulness and perceived ease of use of the garden which the TAM2 states influence usage. Ninety-nine teachers in the United States with current access to a school garden or who had access to a school garden within the last five years participated in the open-ended survey. The responses suggest that the participants perceive the garden to be useful in instruction and positively affect their ability as a teacher. The perceived ease of use was positive as well, however, there are barriers that were mentioned in the responses, such as lack of time, lack of funds, and lack of training. There was no correlation shown between the perceived usefulness and the actual use of the school garden. Respondents mentioned the use of the garden in specific classes, the use of the garden by one assigned person (such as a science lab teacher or farmer), and weather or a short growing season as reasons for lack of school garden usage time. Responses in this study cannot be generalized but may inform future research.

Acknowledgments

First, I would like to thank my family because this work would not have been possible without them. Todd, Ella, and Davis, thank you for being patient with me, eating out all the time, and being understanding when I was focused on my work. To my mom, thanks for all the encouragement and for always cheering me on. To my dad, I wish you could have been here to see me complete this, but I know you are proud of me, as always. I love you all!

To my Saint James family, thank you for your encouragement and help along the way. You have always been behind me in this endeavor, and I appreciate you all!

Thank you to Dr. Kensler who has helped me through this process and whose opinion I respect very much. I appreciate all of your guidance, direction, and patience through my classes and this study. Thank you also to my committee members, Dr. Hahn, Dr. Forbes, and Dr. Bryant, who have also been of support through my classes and this study. Auburn will forever hold a special place in my heart.

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List of Abbreviations

BMI	Body Mass Index
CATES	Children's Attitudes Toward the Environmental Scale
CDC	Centers for Disease Control
DAU	Daily Active Users
ELL	English Language Learner
ESL	English as a Second Language
GREEN	Garden Resources for Environmental Education Now
IHA	Internet-based Health Applications
PBL	Project-Based Learning
TAM	Technology Acceptance Model
TAM2	Extended Technology Acceptance Model
USDA	United States Department of Agriculture
USSGA	United States School Garden Army

Chapter 1: Introduction

School gardens have been a learning tool in the United States since the late 1800s and continue to be a popular educational environment in modern schools. A school garden can encompass many ideas, but at its core, it is a location, mostly outside, where students can spend time experimenting and exploring while learning curriculum standards and lessons that enhance social and emotional growth. This may be in the form of a flower garden or as elaborate as a greenhouse with a multitude of vegetables being produced. No matter the size and shape, the garden offers a unique area where students may learn.

School gardens came to the United States in the late 1800s through the European influence of educational philosophers such as Friedrich Froebel, the father of the kindergarten concept (Sobel, 2016). The first school garden in the United States was started in 1891 at the George Putnam School in Roxbury, Massachusetts, with others in the country soon to follow (Greene, 1910). This whole child concept of learning was soon adopted by the progressive movement, fronted by educational philosopher John Dewey and soon found its way into teacher education at universities (Ralston, 2011). This educationally progressive period in the early 1900s featured an explosion of school gardens, with the United States Department of Agriculture estimating 75,000 gardens in U.S. schools by 1906 (Jewell, 1907).

World War I brought about the creation of the United States School Garden Army (USSGA), which was developed by the Federal Bureau of Education to motivate students to garden and thus alleviate local food shortages caused by the war (Francis, 1919). This focus on local sufficiency continued during World War II with Victory Gardens, which sought to reduce food insecurities on the home front and to supply soldiers overseas with additional rations (Carr

& Mallam, 1943). The end of the world wars also marked a decline in school gardens as the focus changed to industrialism, processed foods, and local supermarkets (Cutler et al., 2003).

It was not until the environmental focus of the 1970s that school gardens began to make a comeback. Environmental education was seen as an important opportunity for students to understand their place in nature and how they impacted the world around them. The 1980s continued this trend with the addition of sustainability, allowing for students to understand the balance between economic growth and environmental conservation (Tilbury, 1995).

School gardens are currently on the rise. Bridging the Gap, a research program dedicated to better understanding how policies affect the diet and obesity of American youth, found when conducting a survey in the 2012-2013 schoolyear that 26.6 percent of US public elementary schools had a garden (Bridging the Gap, March 2014). A majority of the gardens were found in the Western part of the United States in urban elementary schools with higher socio-economic status. They were also more common in schools larger than 450 students (Bridging the Gap, March 2014).

The current focus of school gardens tends to be academic in nature, with the garden offering a hands-on experiential learning opportunity. This lends itself to project-based learning where students understand the real-world connection between what they are learning and the world around them (O'Brien, 2019). These gardens are also naturally used in environmental education and allow students more outdoor time in which to explore and be physically active (Patterson, 2009). This additional outdoor time is crucial to students in today's technology age (Skouteris et al., 2014). The school garden is also being used as a means by which students can grow fruits and vegetables for consumption, increasing the number of healthy foods they are eating and allowing them the chance to try new healthy options (Parmer et al., 2009).

This study seeks to determine the teachers' attitudes and beliefs about the school garden and how that relates to the garden's success. Chapter 1 will present the current benefits schools enjoy from having a school garden as well as the problem of practice in the school garden concept and how teachers perceive it. The purpose of the study is laid out and in it the Extended Technology Acceptance Model, or TAM2, is introduced (Venkatesh & Davis, 2000). This model is the theoretical framework through which the adoption of and teacher attitudes about the school garden will be viewed. The statement of the problem and research questions follow the TAM2. The chapter concludes with the significance of the study, delimitations and assumptions, a definition of terms used within the study, and an overview of the following chapters.

Problem

School gardens are not inexpensive projects. They take much time and money from the schools who choose to undertake this task. Research has been conducted about many aspects of the school garden to better understand the benefits and positively influence the adoption of school gardens. The most mentioned benefits of school gardens include academic achievement (Miller, 2007), social/emotional growth and wellbeing (Williams & Dixon, 2013), increased health (Blair, 2009), increased community involvement (Cutter-Mackenzie, 2009), and a positive and more responsible environmental outlook (Waliczek & Zajicek, 1999). The research thus posits that there are great gains to be had from the addition of the school garden.

Though the benefits have been greatly researched, there are also barriers to the school garden and its use. Schools operate with tight budgets and teachers often feel there are not enough hours in the day to accomplish the curriculum requirements for their classrooms. Thus, a smaller amount of research has been conducted on the barriers teachers perceive in the ability to use the garden in their current curricula or in integrating new garden curricula into their existing

school schedules. Studies have found that resources needed in order for the garden to be successful, such as funding and supplies (Burt et al., 2018), are often not available. Teachers also note that lack of training in how to use the garden (Skelly & Bradley, 2000), insufficient garden staffing (Landry & Logue, 2017), a lack of time in their day (Thorp & Townsend, 2001), and the absence of curricula for utilizing the garden for instruction (Graham & Zidenber-Cherr, 2005) are reasons for a deficiency of garden use and sustainability.

Benefits of School Gardens

Academic Achievement. School gardens offer students the ability to experience hands-on learning in an outdoor environment. This enhances a student's ability to retain learning standards and apply it to real world problems (Lopez et al., 2008). Though many schools do not have a set garden curriculum, it is an excellent addition to current curricula, with the main area of focus being science (Landry & Logue, 2017), with math and language arts rounding out the top three core classes taught using the garden (Williams & Dixon, 2013). The academic benefits also extend to English Language Learners (ELLs) (Cutter-Mackenzie, 2009), special education students (Miller, 2007), and equally across gender lines (Klemmer, et al., 2005). The holistic nature of the garden increases overall critical thinking skills (Mabie & Baker, 1996) and increases scientific learning.

Social/Emotional Growth and Wellbeing. The garden benefits students' social growth, encouraging leadership skills (Fleener et al., 2011), self-confidence (Landry & Logue, 2017), and respect towards nature and those around them (Dyment & Bell, 2008). Students learn leadership skills through the design and development process of the garden as well as during the maintenance of the grounds (Fleener et al., 2011). They learn self-sufficiency and gain empowerment through working in the garden, especially students who come from low income

areas and/or face food insecurities (Reis, 2015). Students who work outside in the garden also show a reduction in stress (Waliczek et al., 2000) and growth in their interpersonal skills due to the less structured learning environment (Landry & Logue, 2017). Discipline issues also declined in students who spent learning time in the garden (Williams & Dixon, 2013).

Increased Health. Student health is positively affected by school gardens. The gardens are often used to teach health and nutrition education, to include healthy eating habits (Langellotto & Gupta, 2012) and increased physical activity (Utter et al., 2016). The addition of a school garden in nutrition education adds another layer of learning about healthy eating and has been shown to increase fruit and vegetable intake by those students who garden (Ober Allen et al., 2008). The outdoor time spent in the garden increases student physical activity by getting them on their feet and out of the traditional classroom setting. This additional activity decreases student obesity (Utter et al., 2016), increases gross motor skills (Wells et al., 2014), and gives students a mental break (Patel, 1996).

Community Involvement. School gardens provide an opportunity for greater community involvement. The school community, including families and other adults in the community, frequently work together to sustain and support the garden (Lucas, et al., 2018; Ober Allen et al., 2008). Partnerships are often formed between schools and local corporations that can support the garden financially and through donations of supplies (Lopez et al., 2008). Local Master Gardeners and Extension agents are excellent resources for schools that can help train teachers, guide student learning, and provide best practices for growing and maintenance of the garden. This increased community involvement allows for mentorship from adults in the community with local students and a way to positively influence local schools (Ober Allen et al., 2008).

Environmental Outlook. Students who garden have a greater appreciation of nature and the world around them (Frantz & Mayer, 2013). The work outdoors allows students the chance to learn about the environment and nature (Alexander et al., 1995). This creates a more positive environmental outlook (Bowker & Tearle, 2007), raises awareness of environmental challenges (Skelly & Zajicek, 1998), and causes students to become a voice for environmental change (Cutter-Mackenzie, 2009). This also creates environmental changes for years to come as students begin to share their learning with others (Frantz & Mayer, 2013).

Perceived Barriers of School Gardens

While the benefits of school gardens have received much attention in research, studies have also been conducted to try and understand why some gardens do not become the successful learning tools they could potentially be. Since teachers are the people most often using the gardens for instruction, they can offer great insight into why some gardens never make it past the excitement of the adoption phase and flounder long term.

Lack of Time and Insufficient Staffing. There are only so many hours in a school day, and teachers feel their days are already full of instruction. The addition of a school garden adds the stressor for teachers to fit an additional instructional tool into their already busy day. Lack of time to utilize the garden in the school day is considered the top reason teachers do not use the school garden during instructional time (Burt et al., 2018). Even if the garden is accepted and used by teachers, there is the additional time needed to maintain the garden. Often schools do not take into account the amount of work it takes to keep a garden flourishing and to organize the garden for academic use (Thorp & Townsend, 2001). If not planned in advance, the maintenance often falls on the teachers creating a negative effect on the sustainability and success of the garden.

Lack of Teacher Training. Teachers must be trained in all new instructional strategies and the school garden is no different in this respect. The lack of training on how to use the garden within the current curriculum or the introduction and subsequent training of a specific garden curriculum creates a situation where teachers do not use the garden for instruction due to lack of understanding regarding how to use it (Landry & Logue, 2017). This negatively impacts student learning within the garden or limits the use of the garden overall. Teachers who receive adequate training, whether from school leaders or community resource personnel, use the garden more effectively and provide an opportunity for experiential learning students would not receive in a traditional classroom (Skelly & Bradley, 2000).

Insufficient Funds and Supplies. The initial funding of the school garden is not problematic for the school. Most school gardens are initially established through a grant or a partnership with a community entity (Skelly & Bradley, 2000). The trouble comes once the garden is in the ground, the initial investment has been spent, and the cost of long-term maintenance begins. This monetary need is often unplanned and does not fit into the school's budget (Burt et al., 2018). Those schools that do consider long-term maintenance costs often choose not to adopt a school garden, potentially at the detriment of the students' academic success (Landry & Logue, 2017). Schools often must be creative in the ways they fund the garden by seeking outside sources for the income, selling produce from the garden, or utilizing community resources when possible (Slow Food USA, 2013).

There has been substantial research on the benefits of the garden with fewer studies focused on the perceived barriers teachers and administrators face in the use and sustainability. What has not been adequately studied is research to understand why some school gardens flourish while others flounder. Is there a pattern among schools with successful garden

programs? How did they more successfully plan for long-term viability? Is there a common narrative in schools with failed gardens? Without understanding how to successfully utilize a school garden and the tools needed to successfully maintain it, school gardens run the risk of becoming obsolete very soon after being introduced to a school, negating the benefits provided to students. Understanding how some schools successfully navigate the initial adoption phase of the school garden and grow into a successful, sustainable program is the focus of this study.

Purpose

In the ever-changing landscape of education, curriculum often changes at a rapid rate to try and take advantage of the latest research. The profession of teaching has changed with the ideas that teachers lecture in isolation to other subject areas and that the global world has become obsolete (Jorgenson, 2006). Professional development is a necessity in order to develop confidence in teachers and allow them to be successful during implementation of the new program (Nevenglosky et al., 2018), ensuring the success of student benefits that can be gained from the new learning tool. The purpose of this study was to ascertain a teacher's attitudes and beliefs associated with the school garden and how it relates to the success of that garden.

The Extended Technology Acceptance Model (TAM2) was created as a way to better understand the use and acceptance of new technology (Venkatesh & Davis, 2000). For this study, the school garden is substituted for a new technology and seen as a tool teachers may use in their instruction to richly facilitate student learning. As with all instructional tools, a teacher's perception of the new learning tool and how they can successfully utilize it within their current curriculum is of utmost importance. The TAM2 posits that the successful use of a new technology is determined by two main factors: the perceived ease of use and the perceived usefulness of the new technology. This study uses the TAM2 as the theoretical model through

which to look at the implementation and success of the school garden. Per the TAM2, teacher-perceived ease of use and perceived usefulness of the new technology, in this case the school garden, will dictate the actual use of the garden in instruction. The success of the school garden and the benefits students can obtain from the garden lies in the ability of teachers to effectively use the gardens in instruction. The TAM2 factors in seven areas (voluntariness, experience, subjective norm, image, job relevance, output quality, and result demonstrability) that directly or indirectly factor into the use and success of the garden. Using elicitation techniques, this study seeks teacher attitudes and beliefs about the school garden to determine how they relate to its success.

Elicitation studies are important for understanding the beliefs of those who are in a specific situation or environment. The beliefs of a given group of people vary from population to population and their behaviors alter given their current environment (Fishbein & Manfredo, 1992). A more specialized elicitation study allows for these groups to be addressed directly as opposed to generalizing information from a similar group or behavior. It is recommended that, before a quantitative study is completed, an elicitation study be conducted to determine the modal salient beliefs, or the set of beliefs of a particular population, of a representative group (Sutton et al., 2003).

An elicitation study is used to encourage people to share their ideas through visual, verbal, or written stimuli and allows participants to have greater understanding and control of the information and research data (Barton, 2015). It allows researchers to gather terminology and wording directly from the target population. This is important for designing any interventions or trainings that may result from the study. An open-ended elicitation survey will also collect information from those who perform a specific behavior as well as from those who do not, in this

case using the school garden for instructional purposes. This gives additional data for addressing the target population in the future and informing the design of any professional development that could positively benefit said population. The subsequent themes and language that are elicited from the survey data can then be used to determine the effectiveness of any interventions built on the original data. Larger, forced response quantitative studies can also be designed and conducted using the emergent themes from the elicited responses. This additional large-scale research allows for more generalizable studies that have greater impact in the survey area (Middlestadt et al., 1996).

Research Questions

The current study seeks to answer the following research questions to help determine the best way to present a new school garden to teachers and the school community:

1. What do teachers report relates to their use of the school garden?
2. How do the attitudes and beliefs of teachers with successful gardens differ from those with unsuccessful gardens?
3. Does a teacher's perceived usefulness of the school garden seem to relate to their frequency of use?

Research Design

This elicitation study surveyed 99 teachers in schools with school gardens in various states of success. The survey consisted of 31 open-ended questions using the Extended Technology Acceptance Model (TAM2) as the theoretical framework. Each area that directly affects the perceived ease of use and perceived usefulness in the TAM2 were assigned multiple questions to help understand their influence in the use of the school garden. Surveys were distributed using social media and utilizing the social media platform's paid advertising feature

when available to target teachers who have within the last five years or are currently teaching in schools with school gardens. An example of social media used is Facebook, which has over one billion users, many who view the site each day (Facebook, 2020). The use of Facebook as a distributor of research surveys has been tested and determined to be an inexpensive way to reach target audience members and disseminate the information in a rapid manner (Thornton et al., 2016).

The first survey question was designed to ensure that respondents have experience with school gardens. If a member chose that they did not have the necessary experience with school gardens, they then exited the interview. The remaining questions were presented in random order. This helps to ensure the needed responses are reached on all survey questions given the length of the survey and the open-ended eliciting nature of the questions. The responses given to the survey were then coded for emergent themes.

Theoretical Framework

With the perceived barriers that have been documented, this study seeks to better understand why some schools are able to successfully sustain a school garden while others wither and disappear over time. The current study utilized the Extended Technology Acceptance Model (TAM2) as a lens through which to view the adoption of the garden program in the school setting (see Figure 1). The Technology Acceptance Model was created in 1989 by Davis to explain the path people take in the adoption and acceptance of a new technology as well as the importance of proper design and introduction of said technology. The Extended Technology Acceptance Model was created by Venkatesh and Davis (2000) to better understand the variables that affect the adoption and intention to use new technology.

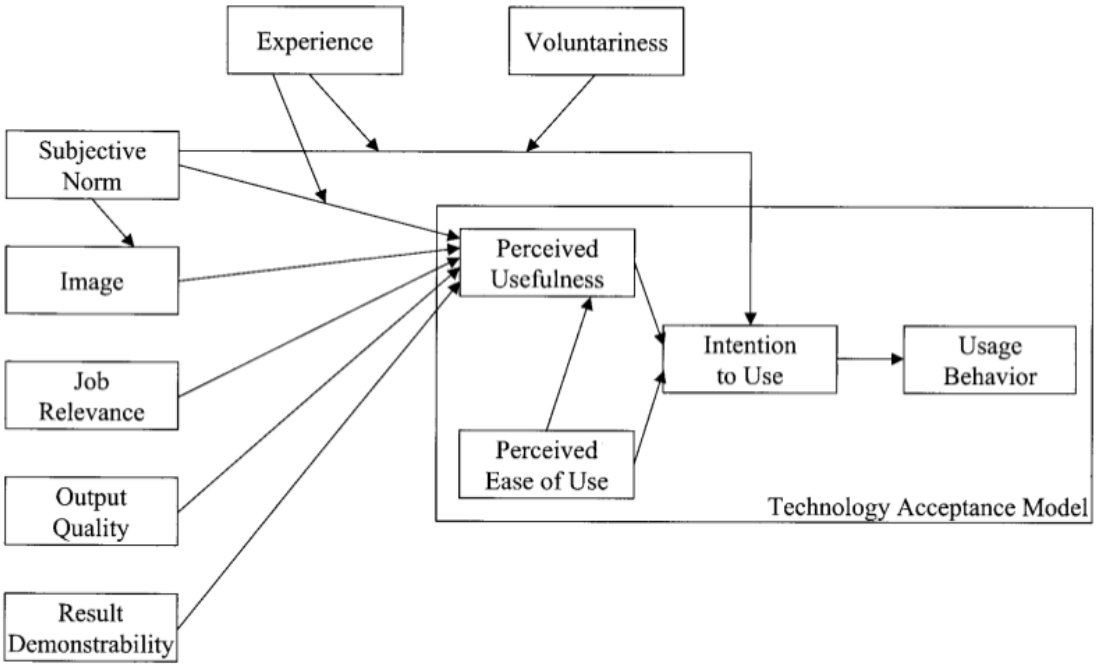
The Extended Technology Acceptance Model (TAM2) is often used in studies determining use of information technology such as the adoption of new technology in a work environment (Venkatesh & Davis, 2000), understanding website use to design better online business models (Wu et al., 2011), and applying understanding to recreational technology use (van der Heijden, 2004). There is a strong research background in using the TAM2 to determine technology use in the medical setting. With information technology becoming common and necessary in the health care industry, researchers have used the TAM2 to better understand new technology adoption and use by medical professionals (Chismar & Wiley-Patton, 2002b) and how best to structure training and adoption measures in a medical setting (Holden & Karsh, 2009). Within education, the TAM2 has mostly been used in studying information technology adoption and use at the higher education level (Kushatmaja & Suryani, 2019).

School gardens are in essence a new educational tool that must be adopted, very similar to the adoption of new technologies; therefore, the use of the TAM2 is fitting in this study. The TAM2 model focusses on the perceived usefulness and the perceived ease of use of a technology as directly responsible for a person's intention to use the technology and their usage behavior. To view the adoption of a school garden through the TAM2 lens, the idea is that perceived usefulness, or how teachers view the benefits of the garden, and perceived ease of use, or how easy teachers feel it is to incorporate the garden into their current curricula and school day, will determine the success of the adoption of the school garden and that the long-term sustainability of the garden will be immediately influenced at this beginning, crucial time of adoption. Understanding how schools with successful gardens that have been sustained for multiple years adopted the program and presented the learning opportunities to teachers will present ideas as to

how best to introduce a school garden to teachers and students so they achieve long-term sustainability and success.

Figure 1

Extended Technology Acceptance Model (Venkatesh & Davis, 2000, p. 188)



Assumptions

This study assumes the following:

- Participants in the study are from schools with school gardens or have worked at schools with a garden within the last five years.
- Participants are truthful in their survey answers.
- Participants are professional educators and their answers reflect their professional opinion.

Delimitations

This study on the elements that influence the success of the school garden has the following delimitations:

1. This study was conducted in the fall and winter of 2020/2021 and surveyed teachers at schools in the United States with current school gardens or schools that once had a school garden that did not achieve sustainability and has since ceased to exist as a learning tool.
2. This study surveyed teachers who teach or have taught at schools with gardens. There are many other school community members who are involved in school gardens, such as administrators, school nutritionists, and community volunteers. The data does not assume the views of the teachers are the same as the other participating members of the school community.
3. The survey and subsequent emergent themes are addressed through the Extended Technology Acceptance Model. This theoretical framework is the tool used to focus the research questions as well as the survey questions.
4. Any conclusions drawn through this research may or may not apply to other schools with gardens. Additional research should be completed to further strengthen the data collected in this study.

Significance of Study

This study seeks to ascertain teacher beliefs and perceptions of the school garden. A great deal of research has been conducted on the benefits of school gardens and how they positively affect students academically, socially/emotionally, influence health and wellness, inform environmental outlook, and enhance community involvement (Blair, 2009; Williams & Dixon, 2013). Less research has been conducted on the perceived barriers, though current research has shown emergent themes among teachers and other school community members who work with school gardens (Burt et al., 2018). Though the benefits and perceived barriers have been the

focus of research, teacher attitudes and beliefs about school gardens and the role those beliefs play in the success and sustainability of the garden have not.

The understanding of what positively affects the adoption and acceptance of the school garden will help schools in the creation and adoption process and help to ensure an enriching learning environment with beneficial results for students and the school community (Nevenglosky et al., 2018). Emergent themes and data from this study can be used to better plan for the adoption phase of a school garden and will help in writing and/or directing teacher training on school gardens to help ensure their success and survival (Darling-Hammond et al., 2017). This helps in the sustainability and success of the school garden so students can continue to receive the benefits from this learning tool. It also helps schools to continue a program in which they have invested their money, time, and physical labor to reach success and sustainability.

Definition of Terms

Experience - A person's background with the introduced technology (Venkatesh & Davis, 2000)

Image - The potential boost in status from adopting and using the new technology (Venkatesh & Davis, 2000)

Intention to Use - The amount of use a person intends to use a technology (Venkatesh & Davis, 2000)

Job Relevance - The relevance of the technology to the job needing to be performed (Venkatesh & Bala, 2008)

Output Quality - The quality of work performed using the technology (Venkatesh & Bala, 2008)

Perceived Ease of Use – The believed ease of use of a new technology (Venkatesh & Davis, 2000)

Perceived Usefulness – The believed usefulness of a new technology in relation to job achievement (Venkatesh & Davis, 2000)

Result Demonstrability - The ability to show the results of the adoption of the technology (Venkatesh & Bala, 2008)

School Gardens - A location, most often outside, where students can spend time experimenting and exploring while learning curriculum standards and lessons that enhance social and emotional growth; it may be a large area or a small patch of land in which students grow flowers (United States Department of Agriculture, n.d.)

Sustainability - The ability to maintain something at a desired rate or level for a specified time (Tilbury, 1995)

Subjective Norm - The assumed pressure and opinion of others that influence use of technology (Venkatesh & Bala, 2008)

Usage Behavior - The actual amount a person uses a technology (Venkatesh & Davis, 2000)

Voluntariness - The perceived voluntariness of the adoption of the technology, whether it is mandatory or voluntary (Venkatesh & Davis, 2000)

Organization of Study

Following Chapter One's introduction to the study, Chapter Two contains a literature review that consists of an overview of the use of school gardens, the history of school gardens, their current uses, the benefits and perceived barriers found in research, and the Extended Technology Acceptance Model and its use in this study. Chapter Three gives a more in-depth view of the methodology of the current study to include the open-ended survey.

Chapter 2: Related Literature

Introduction

This chapter presents the current research and literature on school gardens, including (1) an overview of the past and current uses of school gardens, (2) the history of school and learning gardens, (3) the present movement in establishing school gardens, (4) the identified benefits of an on-site school garden, (5) perceived barriers of school gardens, and (6) the phenomenon of the sustainability and success of a school garden. The purpose of this literature review is to present and explicate the current research on school gardens, explore potential omissions in research pertaining to school gardens, and indicate how the current study seeks to address one such gap in school garden research.

Overview of the Use of School Gardens

School gardens are a unique construction that allows for multiple uses throughout a school. A school garden was defined by Mary Louise Greene (1910) as the following:

> any garden where children are taught to care for flowers, for vegetables, or both, by one who can, while teaching the life history of the plants, and of their friends and enemies, instil [sic] in the children a love for outdoor work and such knowledge of natural forces and their laws as shall develop character and efficiency. (p. 3)

This definition, though dated, still holds true today. School gardens may be flower gardens outside of classrooms where students study the parts of flowering plants. They may be vegetable gardens that supply additional produce for student lunches. It can be a pollinator garden where students learn how animals such as bees and birds participate in the life cycle of plants. No matter the form, the outdoor cultivating and caring for the garden provides students ownership of a facet of their education and provides benefits from this experiential form of learning.

Many schools have developed an additional curriculum for the school garden with great success (Alexander et al., 1995; Dirks & Orvis, 2005; Smith & Motsenbocker, 2005; Waliczek & Zajicek, 1999), others have integrated it into their existing standards (Graham & Zidenber-Cherr, 2005), while some teachers and educational leaders allow the garden to drive instruction and experience (Miller, 2007; Thorp & Townsend, 2001). The core subject areas most likely to involve students in experiential learning opportunities are science, language arts, and math, with nutrition, environmental education, and social skills also taught in the garden (Graham & Zidenber-Cherr, 2005; Miller, 2007).

On-site gardens are used by schools to positively influence student food choices and educate them on the options available for growth in the region. These gardens offer an environment for students to experience new fruits and vegetables (Ober Allen et al., 2008; Parmer et al., 2009; Robinson-O'Brien et al., 2009), increase health and nutrition education in classrooms (Landry & Logue, 2017; Langellotto & Gupta, 2012), use produce in existing school lunch or snack programs (Canaris, 1995; Jaeschke et al., 2012), and increase food literacy in students (Reis, 2015).

Schools are using gardens to create a sense of community with school members and outside organizations. These opportunities for community socialization include students working directly with teachers or other school members (Thorp & Townsend, 2001; Waliczek et al., 2000), parents and grandparents (Canaris, 1995; Cutter-Mackenzie, 2009), garden experts such as a Master Gardener (Alexander et al., 1995; Patel, 1996), and other community members who wish to be involved (Ober Allen et al., 2008). It also allows an opportunity for school community members to invest in a school through their time volunteering as well as offering monetary support.

School gardens offer a distinctive learning environment to students and can be used across many educational areas. Over time, the use of the gardens has changed to fit current teaching styles and curricula; however, the core of the garden as an outdoor, experiential learning environment has remained the same. The origins of these gardens help to explain the background and to understand the direction of growth moving forward.

History of School Gardens in the United States

To better understand the current philosophy of school gardens, attention must be given to the pedagogical foundation on which they originated. The history of school gardens as learning and socialization tools began in Europe approximately two centuries ago with philosophers John Amos Comenius and Jean-Jacque Rousseau who pointed to the necessity of nature education for appreciation and the foundation of later learning (Subramanium, 2002). Comenius stated, "A school garden should be connected with every school, where children can have the opportunity for leisurely gazing upon trees, flowers and herbs, and are taught to appreciate them" (Weed & Emerson, 1909, p. 27). In the early 1800s, this was echoed and further built upon by Friedrich Froebel, the father of kindergarten, who viewed play-based, experiential learning opportunities as the focus of early childhood education (Sobel, 2016). School gardens in Europe were also adopted as a means for teachers to supplement their income while utilizing it as a teaching tool (Jewell, 1907). It was not until the late 1800s when the educational philosophy in the United States recognized the benefits of these outdoor areas through exposure to the European way of outdoor learning (Subramaniam, 2002).

Maria Louise Greene (1910) detailed the history of the school garden in the United States up until 1900 as minimal, perhaps four or five total gardens in the country. In 1891, Henry Lincoln Clapp, Master of the George Putnam School in Roxbury, Massachusetts, traveled to

Europe to view and study school gardens. Upon his return, the George Putnam School adopted the European philosophy of whole child learning and became the first school garden of record in the United States (Greene, 1910). This was immediately followed by schools across the country that viewed nature as a learning tool. Colleges and Universities, such as The University of Pennsylvania and New York University, began offering teacher training courses during the summer to instruct educators on how to set up and operate a school garden and the pedagogical connection to their current curriculum.

The progressive movement in education encouraged the idea of educating the whole child and was espoused by the teachings of educational philosopher John Dewey. In his work of progressive theories, he sought to educate children through an interactive process, furthering their academic and social growth through hands-on learning. The University of Chicago Experimental School, of which Dewey was co-founder with university president William R. Harper, was opened in 1896 and focused on student growth in emotional, social, and intellectual areas. Dewey espoused the idea that the school garden allowed for social interactions while sharing ideas that created opportunities for learning beyond the classroom (Ralston, 2011). School gardens reached their height during the Progressive Movement by 1906, with the United States Department of Agriculture (USDA) estimating more than 75,000 school gardens, with a majority in Illinois, New York, Pennsylvania, and Massachusetts (Jewell, 1907).

As a response to World War I, the Federal Bureau of Education introduced the United States School Garden Army (USSGA) in March of 1918. This program was developed and organized by the federal Bureau of Education and received funding from the War Department. The motto was “A garden for every child. Every child in a garden” (Department of the Interior, 1918). Pamphlets of information and curriculum were sent to teachers and schools around the

country, entreating upon their patriotism and their ability to help in the war effort from home. Students were encouraged to be "soldiers" and use school and home gardens to grow crops that would offer locally grown produce and a sustainable food source that would help offset any food insecurities caused by the war (Francis, 1919). In 1918, President Woodrow Wilson stated in a letter to Franklin K. Lane, the Secretary of the Interior, that children working in school gardens "is just as real and patriotic an effort as the building of ships or the firing of a cannon" (Department of the Interior, 1918, p. 3).

World War II ushered in the era of the Victory Garden, a way to stretch ration coupons and feed American soldiers fighting around the world. Families joined in the "fight" and gardens were planted across the country in urban, suburban, and rural areas. At its height, students were responsible for producing 40% of all vegetables grown in the United States and the number of gardens topped the 20,000,000 mark (The National WWII Museum, n.d.) with over 169,000 acres planted (Carr & Mallam, 1943). Produce was used in school lunches and any additional food was canned for winter months or shipped to soldiers.

At the end of World War II, these gardens became an anomaly and not the norm, as the country increasingly turned to industry and technology. The United States government no longer promoted victory gardens and people assumed food production would return to normal (Reinhardt, n.d.). Food preparation became industrialized and made processed foods less expensive and more readily available for consumers (Cutler et al., 2003). The popularity and availability of supermarkets also influenced the use of gardens, both in the community and at schools (Ho, 2012). As those involved in the war effort overseas came home, the United States experienced a mass of suburban growth and movement of workers into more industrial areas. The gardens that did remain became smaller and contained in private backyards, contradicting

the large-scale community and school gardens that had been such a popular war effort (Smithsonian Institution, 2019).

School gardens once again surged during the 1970s as the country became more environmentally aware. The decade was ushered in by the first Earth Day celebration on April 22, 1970, and environmental education became a focus because of the belief that students needed to understand the connection between nature and humans and their role in the environment. This environmental concentration sparked renewed interest in school gardens during this time. The term sustainability was brought into the conversation of environmental education in the 1980s. It referred to the balance between economic development and environmental conservation, setting environmental concerns within proper socio-political contexts (Tilbury, 1995).

Today's school gardens have taken the sustainability aspect of the 1980s and 90s and the experiential learning of earlier decades to advance it to a movement that incorporates environmental education, health education, and the experiential learning espoused in modern curriculum. Schools have utilized the unique learning setting by instilling the academic foundation they seek while offering students a way to experience nature. The following section gives an overview of ideals adopted in the current school garden movement.

Current School Garden Movement

The evolution of the learning garden in the United States is reflective of the social viewpoints and change within the country over time. The sustainability movement has become more pronounced considering recent studies on climate change and concern over student obesity levels, lower amounts of physical activity, and potentially excessive screen time with the current inundation of readily available technology (Skouteris et al., 2014). School gardens readily lend

themselves to the following four areas of focus: 1) farm to school, 2) environmental education, 3) outdoor movement, and 4) project-based learning.

Farm to School

> Farm to school is defined by Anupama, Azuma, and Feenstra (2008) as the following: a school-based program that connects schools (K-12) and local farms with the objectives of serving local and healthy foods in school cafeterias or classrooms, improving student nutrition, providing health and nutrition education opportunities, and supporting small and medium-sized local and regional farmers. (p. 230)

The current farm to school movement is showing tremendous growth recently in response to an increase of childhood obesity (Lee et al., 2019). There were fewer than 10 schools participating in farm to school programming in 1998 (Anupama et al., 2008) while there were 42,587 schools reaching 23.6 million students in 2015 (United States Department of Agriculture, 2015). These programs offer an opportunity for students to have access to more nutritional foods while also involving the entire school community, including teachers, administrators, cafeteria workers or nutritionists, and parents (Anupama et al., 2008). School gardens are one such way to provide a farm to school environment with the added benefit of allowing students to get a first-hand understanding of where their food comes from as they are personally responsible for the planting and care of the plants that produce fruits and vegetables used in the preparation of their school meals.

The creation of a school snack garden in an elementary, multi-grade class in Vermont showed positive results in the improvement in the health content of their snack options (Canaris, 1995). Children showed a high level of investment in the growth of the produce and were excited and willing to try options from the garden they had earlier refused. A side benefit of this snack

garden was the real life, hands-on learning the students were exposed to in the process. Students learned math skills through measurements in cooking and picking produce, learned about insects that lived in the garden, and were instrumental in the drafting and plotting of the garden area. It quickly became a community partnership, with parents becoming involved in the garden (Canaris, 1995). Cirillo and Morra's (2018) study to understand the sustainability of farm to school programs echoed these findings. They interviewed ten Vermont principals whose schools participated in a farm to school program. These participating schools showed an increase in nutrition education, hands-on learning in the garden, and community partnerships with local farmers (Cirillo & Morra, 2018). Most programs included a school garden, utilized the produce in the school lunch program, and used the garden as a hands-on learning opportunity. Cirillo and Morra (2018) concluded that a school's culture, including internal support and communication of benefits, is a strong determining factor in the success of a farm to school program.

A study by Graham and Zidenber-Cherr (2005) surveyed all fourth-grade teachers in California with a school garden. Only 38% of responding teachers indicated that edible produce was being grown in the school garden, although 43% felt the garden had increased the health content of the students' eating habits. One teacher pointed to "salad parties" their school had that energized the students and others saw a shift from fast food choices to fresh fruits and vegetables. With 46% of teachers stating that the garden was not effective or just slightly effective at enhancing the school meal program, there is still room to grow in the farm to school movement, even among those schools that already have a school garden in place. A review of thirty-eight farm to school reports and studies showed that farm to school programs promote positive changes in student fruit and vegetable consumption (Anupama et al., 2008). The study also pointed to some programs seeking to influence dietary behavior outside of school and

encouraging students to make lifestyle changes through knowledge of healthy eating and local agriculture.

Though the farm to school movement encapsulates more than just the school garden, the availability of fresh produce at school and students' ability to work in the garden and feel ownership is a unique experience that school gardens offer. Research suggests this use of the garden in the school setting can positively impact student health and wellness and potentially impact academic learning. Though there are many benefits to the farm to school movement, studies have found that barriers exist in the implementation. The largest struggles for participating schools are financial resources, policies and food procurement regulations, and internal and community support systems (Lee et al., 2019; Anupama et al., 2008; Cirillo & Morra, 2018). Successful and sustainable farm to school programs in schools are "recognized when FTS is explicitly connected to other initiatives, integrated into daily practice, and supported through policies and resource allocation" (Cirillo & Morra, 2018, p. 6).

Environmental Education

> Environmental education is defined by the Environmental Protection Agency (2018) as the following:
>
> a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions. (Environmental Protection Agency, 2018)

The teaching methods used in environmental education include hands-on learning, applicable curriculum, and a focus that encourages emotional engagement from students (Riordan & Klein, 2010). The school garden allows for all of these methods as well as forging an emotional

connection to the environment. The focus on environmental education that began in the 1970s aims to educate students and cause them to positively act in concern for the world around them, especially with growing concerns of diminishing resources and global warming. School gardens remain an optimal tool for exposing students to these environmental concerns and educating them on their place in the world around them.

A study by Aguilar et al. (2008) of third- through fifth-grade students in Texas found that any kind of exposure to gardening promotes a positive environmental attitude and locus of control or understanding their control of the world around them and the ability to positively influence environmental issues. In fact, the study suggests that a formal gardening curriculum may not even be needed for students to benefit in the area of environmental concern and that the action of being in nature and working in a garden will raise awareness for the world around them. In fact, when student learning is linked to real world issues, they are much more likely to deem it important and impactful (Riordan & Klein, 2010). Understanding their place in the world helps them to understand how their choices affect the environment and their own day-to-day lives.

A study by Karsh et al. (2009) used the administration of the Children's Attitudes Toward the Environmental Scale (CATES) test as a pre- and post-test for students who participated in the Coastal Roots program that teaches about the Louisiana wetlands and a control group who did not participate. Converse to the previously mentioned study, the evaluations showed that students who receive direct instruction in environmental concerns are positively impacted and grew in their CATES score in the post-test, whereas those who received no direct instruction failed to grow. Fisher-Maltese and Zimmerman (2015) conducted a study with four second-grade classrooms that used their school gardens to teach a four-week insect

curriculum. Though environmental attitude change was not the original focus of the study, the authors discovered the students had a more positive outlook and were more empathetic toward the environment after the time spent in the garden studying insects. With the idea that direct environmental instruction may provide positive growth in students, Stern et al. (2014) evaluated 66 articles on environmental education programs published between 1999 and 2010 to determine what was effective in current environmental curriculum. They found experiential learning opportunities focused on real-world problems that were student-centered and empowered learners to be the most effective. The social aspect of environmental education was also important. The authors pointed to the collaborative nature of the group work and teacher engagement to be important factors (Stern et al., 2014).

Environmental education remains a focus at many schools, and the school garden offers an opportunity for it to be seamlessly incorporated into experiential lessons in science and other subject matters or for students to just spend time in nature. The excitement created by working in the garden is a positive environment in which students can learn how to protect natural resources and appreciate their place in nature, whether through direct instruction or simply experiencing the outdoors.

Outdoor Movement

As technology has become more readily available and accessible to students, there has been a movement to promote increased time outside to counteract any perceived negative effects of prolonged screen time (Sobel, 2016). The movement of outdoor education is defined by Palavan et al. (2016) as "experimental, hands-on learning in real-life environments through senses, e.g., through visual, auditory, and tactile means, improving students' learning and retention of knowledge as a result" (p. 1885). Students with a school garden are given the "real-

life environment" to experientially learn curriculum and standards presented to them. Thus, the school garden is just one area of the current outdoor movement.

David Sobel (2016) wrote about this outdoor movement in North America. He focused on the growth of nature preschools and forest kindergartens that allow students to spend most of their educational time outside, despite inclement weather or conditions that could be considered dangerous in our society. Like school gardens, the idea for these schools was born out of the nature centric, European kindergarten model created by Friedrich Froebel in the early 1800s. As traditional schools are becoming increasingly centered on testing, the outdoor movement seeks to create advanced thinking through hands-on experiences. Sobel stated that students who are educated in these outdoor environments developed higher-level thinking skills, problem-solving abilities, and emotional intelligence than their cohorts in traditional schools and were able to adapt and excel when they had to join a traditional learning environment. These positive gains by students who have the experience of an outdoor education is seconded by Palavan et al. (2016), who found in their research that outdoor education improves self-confidence, concentration, ability to retain knowledge, and comprehension, as well as social, language, and physical skills. Unfortunately, they also found that teachers were less likely to utilize the outdoors for learning due to their concern about meeting deadlines and covering course materials in an allotted time as well as the fear of keeping students safe due to larger, crowded class sizes. Teachers need to receive professional development to build their theoretical knowledge of outdoor education, to learn the benefits of outdoor education, and to understand how to better utilize outdoor spaces in their everyday educational practices (Palavan et al., 2016).

Patterson (2009) focused on the importance of outdoor time and environmental education at the middle and high school levels. Through the hands-on, experiential learning environment

created in environmental education programs, students became more aware of their global responsibility. Patterson stated that the benefits of such programs include a connection with the community, academic diversity, cross-curricular experiences, and the ability to experience real-world problems and apply solutions to better understand current environmental issues. True outdoor learning leads to ecological literacy where students are able to view themselves as part of nature (Hammarsten et al., 2019). These students feel a responsibility to care for animals and plants they encounter, to care for the world around them as a whole (Hammarsten et al., 2019) and to have a positive appreciation of nature that is directly tied to their time spent outdoors (Kalvaitis & Mondhardt, 2015).

By allowing students more outside time, schools are creating environments where the students can experience the world around them and also promote real-world problem-solving without the use of technology. Studies have found that outdoor education improves students' social skills, personal development, academic achievement, and environmental awareness (Lien, 2007) and that these students are more capable to experience the wonder and joy of being outside and are more inclusive, adaptable, and prepared for the world around them (Patterson, 2009; Reis, 2015; Sobel, 2016; Thorp & Townsend, 2001).

Project-Based Learning

Project-based learning (PBL) is defined by O'Brien (2019) as "an instructional methodology that encourages students to learn and apply knowledge and skills through an engaging experience. PBL presents opportunities for deeper learning in-context and for the development of important skills tied to college and career readiness" (para. 1). John Dewey (1916) referred to it as "active learning" where students connect the content they are learning with the world around them. This holistic approach to education is a natural fit for a school

garden, where students experience hands-on problem-solving while learning content-based standards.

Smith and Motsenbocker's (2005) study of the Junior Master Gardener's Program in three fifth-grade inner city East Baton Rouge, Louisiana, schools pointed to the positive impact of garden-centered, project-based learning. The data showed that students who had an additional hands-on experience in the garden scored significantly higher on post-tests assessing student science achievement and knowledge than those in the control group who only received classroom instruction. The garden provided a "living laboratory" in which students could experiment in real-world situations and in unpredictable environments, allowing them to become better problem solvers and adjust to variables beyond their control. Another study showed preschool students can more easily transfer project-based academic learning to their long-term memory because it allows them to actively use their senses in the process (Yildirim & Akamca, 2017). A study of thirty-five preschool students who participated in a ten-week unit that had outdoor activities showed that they improved their cognitive and linguistic abilities, their interpersonal skills, and their motor skills. As these studies express, students who are outside and experience problems with real-world solutions are better able to make the connection between what is being taught in a classroom and their daily lives which, in turn, allows for academic achievement (Smith & Motsenboker, 2005; Yildirim & Akamca, 2017).

A study by Waliczek et al. (2001) shows a positive correlation between project-based learning in the garden and students' attitudes toward school. Students grades two through eight in seven schools located in Texas and Kansas participated in the Project GREEN garden program. This participation, which provided hands-on learning experiences, yielded a greater socialization between students and a more positive attitude about school and learning, especially

among female students. Older students showed higher interpersonal relationships, which was thought to come from the internal communication while they were working independently in the garden. Peace Gardens of Sicily is another program that seeks to engage students in creating and tending to a garden, allowing for academic, social, emotional, and physical growth of students (Kummings et al., 2019). Students take the subject matter outside so they can experience it in a real-world setting. These gardens are also used as an opportunity to include students with disabilities and marginalized students. The inclusive nature of the outdoors and project-based learning is helping students to build communities while also reaching academic goals through problem solving (Kummings et al., 2019).

The ability for students to explore and experiment in an outdoor environment, such as a school garden, allows students to experience real-world learning and fosters the ability to tie their learning to something concrete. Project-based learning, which is a student centered and interdisciplinary approach to learning, correlates well with school gardens and offers an alternative to traditional, teacher-led classrooms. “Gardening projects require the use of critical thinking skills, project planning and organization, collaboration, teamwork, and other skills and dispositions that are not found in state-mandated curriculum content standards, but that are certainly important skills and dispositions for life” (Kummings et al., 2019, p. 17). This brings to the forefront the benefits of school gardens and experiential learning.

Benefits

The learning experience the garden affords students leads to greater understanding of concepts through the manipulation of the garden’s elements. Research points to many benefits for the students including (a) a more positive and responsible environmental outlook (Alexander et al., 1995; Skelly & Zajicek, 1998; Waliczek & Zajicek, 1999), (b) academic achievement

(Klemmer et al., 2005; Miller, 2007; Rye et al., 2012), (c) favorable social outcomes (Fleener et al., 2011; Thorp & Townsend, 2001; Williams & Dixon, 2013), (d) increased community involvement (Cutter-Mackenzie, 2009; Ober Allen et al., 2008; Patterson, 2009), and (e) beneficial health and nutrition changes (Blair, 2009; Bowker & Tearle, 2007; Langellotto & Gupta, 2012; Parmer et al., 2009). Though the following studies are not exhaustive, they are representative of work that exemplifies the importance of school gardens in these areas.

Environmental Outlook

Though school gardens were not specifically designed to be tools of environmental education, the current concerns and lack of student environmental knowledge has led to it being used toward this goal (Waliczek & Zajicek, 1999). Students who spend time outside in the garden speak of having a sense of wonder and state they gain great pleasure from learning in an experiential and natural environment (Thorp & Townsend, 2001). The garden also brings a connection to nature (Frantz & Mayer, 2013) and a greater awareness of the world around them (Miller, 2007) for both students and teachers involved in garden work. Multiple studies support these findings and point to a more positive overall outlook on the environment and the outside world surrounding students (Aguilar et al., 2008; Alexander et al., 1995; Dirks & Orvis, 2005; Karsh et al., 2009; Landry & Logue, 2017; Skelly & Bradley, 2000; Skelly & Zajicek, 1998; Waliczek & Zajicek, 1999; Waliczek et al., 2000).

In looking at research, one finds three areas that correlate throughout the studies regarding school gardens and environmental education: the knowledge students gain through interacting with nature via the garden, the positive attitude towards the environment through this experiential learning, and the idea that students then become change agents to the world around them in respect to their environmental outlook. First, students gain knowledge of the

environment, nature, and the world around them through the hands-on learning that occurs in the garden (Alexander et al., 1995; Waliczek et al., 2000). Blair (2009) found in a review of literature on the benefits of school gardens that students showed a more positive attitude toward the environment from time spent outside in the garden. They suggested the design of the garden and the learning experience students were exposed to be given thoughtful attention from teachers and administrators because of its importance in students' environmental education (Blair, 2009). In a study of underperforming elementary school in the Midwest, Thorp and Townsend (2001) found that teachers used the gardens as a means for students to gain life experience and interact with nature they were not always exposed to in their everyday lives. These teachers suggested using the garden in a very natural way and allowing the students' experiences to direct the learning. They felt that it was logical for the world around the students to guide how students learn as opposed to a curriculum directing learning (Thorp & Townsend, 2001).

Secondly, there is a great amount of research to support the findings of the connection of time spent in a school garden with a more positive environmental outlook in students (Bowker & Tearle, 2007; Patterson, 2009; Alexander et al., 1995; Miller, 2007). Skelly and Zajicek (1998) studied students in second and fourth grades in four elementary schools in Texas to learn the effects of participation in Project GREEN (Garden Resources for Environmental Education Now), a program designed to help teachers use a garden to teach environmental lessons. The students who participated in the program showed a greater understanding of human impact on the environment and a more positive attitude toward the world around them (Skelly & Zajicek, 1998). Skelly and Zajicek (1998) stated that a formal curriculum and structure to the environmental learning would garner greater gains than a more experiential learning, which is in direct conflict to the findings of Thorp and Townsend (2001) mentioned above. A study by

Aguilar et al. (2008) found that any exposure to the garden would positively influence the way students viewed the environment. The greatest influence in attitude was the hands-on experience students had in the garden. The very awareness of nature brought about by time in the garden in preschoolers and kindergarteners in a Nebraska school created a deeper appreciation of the outdoors and was expected to influence students' attitudes toward the environment for years to come (Miller, 2007).

Finally, positive attitudes toward the environment that occur from time in school gardens creates a voice of change for students and allows them to be an agent of change in the world around them. Students who participated in Coastal Roots, a program that teaches about Louisiana wetland loss, not only gained an understanding of their role in the environment but were more likely to volunteer to help combat the loss (Karsh et al., 2009). Other studies showed that students were proud of what they had learned about the environment and the garden and were excited to educate others. Students who felt their time in the garden had positive environmental implications felt a sense of agency to protect the environment (Cutter-Mackenzie, 2009), while others were excited by their environmental program and felt they could positively impact others by sharing what they had learned (Dirks & Orvis, 2005).

The goal of environmental education is to create positive change in nature and the world around us (United States Environmental Protection Agency, 2018). Frantz and Mayer (2013) found a connection between students who cared about the environment and their willingness to perform behavior labeled as "inconvenient" to cause positive change. If time in the school garden learning about the environment, whether directly or indirectly, creates a positive outlook and greater understanding of man's impact on the environment, then access to gardening time plays a large part in creating environmental change over time. Students share their learning with

others and then become change agents for years to come (Frantz & Mayer, 2013; Dirks & Orvis, 2005, Cutter-Mackenzie, 2009).

Academic Achievement

Since a current goal of the school garden is to provide experiential learning, there has been research dedicated to the academic outcomes associated with participation by students in garden curriculum. Research shows that most school gardens are used for academic instruction (Landry & Logue, 2017), and students who spend time in a learning garden have higher science achievement scores (Klemmer et al., 2005; Pigg, Waliczek, & Zajicek, 2006), improve in their overall academic achievement (Lopez et al., 2008), take greater risks (Miller, 2007), and have a more positive response towards learning (Bowker & Tearle, 2007). This academic achievement also extends to English as a Second Language (ESL) learners (Cutter-Mackenzie, 2009) and special education students (Miller, 2007; Rye et al., 2012).

Though the garden is usually not the focus of curriculum or student learning, it is an effective tool in enhancing current curriculum or standards that are already being taught (Pigg et al., 2006). Active or experiential learning coincides with greater academic achievement and the ability to retain information and transfer learning to real-world situations (Lopez et al., 2008; Yildirim & Akamca, 2017). Elementary students who participated in a gardening program in Texas showed higher science achievement scores than their counterparts who had only traditional instruction time, and this achievement was across gender lines (Klemmer et al., 2005). In fact, the garden has been shown to enhance academic learning across gender and differing ability levels. Miller (2007) found in a study of preschoolers and kindergarteners that the hands-on-learning aspect of the garden and the interest girls showed was a positive for girls' future interests in math and science, as they would be more comfortable with these subject areas after

the garden experience. This learning also applies to students learning English as a second language. Students not only learn academic concepts in the garden but increase their English language abilities and understanding through time in the garden (Cutter-Mackenzie, 2009). The hands-on time in the garden is also particularly good for students with disabilities. Traditional classrooms that are lecture-based are not an ideal environment for student with disabilities. Garden-based learning allows these students the opportunity to experience a kinesthetic learning environment, make authentic connections to classroom curriculum, and increase academic achievement (Rye et al., 2012).

Science is a natural fit when integrating a school garden into existing curriculum or utilizing a specialized gardening curriculum. It is the primary subject taught in the garden (Landry & Logue, 2017; Jaeschke et al., 2012), with math and language arts also being integrated (Williams & Dixon, 2013). A study by Graham and Zidenber-Cherr (2005) showed that teachers at schools with gardens think it is effective in boosting student academic achievement and a very effective tool in student science achievement. In a study of third-grade students and teachers participating in a Junior Master Gardener program, students made significant gains in scientific knowledge (Dirks & Orvis, 2005). Teachers also enjoyed the program and found it easy to incorporate into their current science curriculum. Skelly and Bradley (2000) also found teachers felt the garden helped students learn academic objectives better and that it enhanced student learning.

The garden is an effective tool in all areas of instruction and is holistic in nature, nurturing a whole child learning that may not otherwise be addressed in a traditional classroom (Mabie & Baker, 1996). A study of preschoolers and kindergarteners noted that the outdoor garden/greenhouse time “addresses the needs of the whole child” (Miller, 2007, p. 64) and

"provides meaningful, hands-on learning and the skills children develop will help them be more successful in school…these skills include visual-spatial, language/literacy, science, math, body awareness, and interpersonal and intrapersonal skills" (Miller, 2007, p. 59). Mabie and Baker (1996) found that time in the garden, regardless of the subject being taught, increased students' abilities to "observe, communicate, compare, relate, order, and infer" (p. 5), increasing critical thinking skills that will enhance future scientific learning.

Social Outcomes

A perceived indirect benefit of school gardens is the positive social growth of students and the school community. Time in the garden teaches students life and social skills such as leadership (Fleener et al., 2011), self-confidence (Landry & Logue, 2017; Miller, 2007), decision-making (Lekies & Sheavly, 2007), inclusivity (Dyment & Bell, 2008), self-reliance (Patel, 1996; Reis, 2015), and an increased self-esteem (Waliczek et al., 2000). Students also develop morally outstanding qualities like respect towards others, themselves, nature, and cooperation with others (Alexander et al., 1995; Dyment & Bell, 2008).

Leadership skills are an important indirect result of gardening in the school setting, especially when students are included in the planning and decision-making process (Fleener et al., 2011). Fleener et al. (2011) described students participating in a Junior Master Gardener program as attaining self-competence through social skills, social awareness, and self-confidence. Another study by Lekies and Sheavly (2007) found students who participated in Greener Voices, a children's gardening program, as actively participating "in the decision-making, leadership, and other higher-level involvement" and were "more strongly linked to gardening interests both directly and indirectly through gardening skills" (Lekies & Shevly, 2007, p. 73). Gardens also offer the opportunity for students in lower income areas to gain

confidence and self-worth (Patel, 1996). The garden presents a means for students to become self-sufficient, to be proud and take ownership, and to attain well-being (Patel, 1996). Reis (2015) found in a study about the impact of school and community gardens on food insecurity that the garden promotes resilience in these impacted students and provides empowerment for participating students. Students with lower incomes receive the most benefits from school gardens due to the opportunity gardens offer to alleviate poverty related food issues (Utter et al., 2016).

Another positive aspect of the garden is the well-being of students attributed to time spent outside and their participation in a gardening program. Waliczek et al. (2001) found in a study of students participating in Project GREEN that interacting with nature impacted psychological factors resulting in more positive attitudes toward school. Gardens were seen as relaxing for students and causing a reduction in stress (Waliczek et al., 2000). The gardens offer a place where students and teachers feel more control of their environment and a place where they can "experience comfort, security, belonging, pleasure, and wonder" while in nature (Thorp & Townsend, 2001, p. 357). Interpersonal skills are also positively affected, as students have the opportunity to interact with others in their time outside in a less structured environment (Landry & Logue, 2017). The nurturing aspect of taking care of the garden also created an improved sense of self as students felt they were doing positive work in the environment (Blair, 2009). In addition to these positive psychological factors for participating students is the reduction in discipline issues. A synthesis of research on school gardens found discipline as positively affected 100% of the time (Williams & Dixon, 2013), while Dyment and Bell (2008) found students who had green school areas to be less aggressive, as bullying and discipline issues decreased in their schools.

Though social skills and development are not often an area that is intentionally targeted by school gardens and outdoor programs, the research is clear on the positive impact they provide in this area. Gardens are more inclusive in nature (Dyment & Bell, 2008) and allow students to grow, gain self-confidence, and develop socially through interaction with others and the ownership involved with taking care of a garden (Williams & Dixon, 2013).

Community Involvement

School gardens act as a "catalyst for social interaction" (Patel, 1996, p. 36) and encourage involvement from students' families (Alexander et al., 1995; Cutter-Mackenzie, 2009; Lucas et al., 2018), adults in the community (Ober Allen et al., 2008), gardening experts like Master Gardeners or Extension agents (Alexander et al., 1995), and corporate partners. This interaction and involvement create a more positive school culture and community in which students and learning can thrive (Thorp & Townsend, 2001).

Waliczek et al. (2000) surveyed adults who accessed the KinderGARDEN homepage through Texas A&M's Horticulture Department webpage to gain information about their participation gardening with children. Most of the students gardened with teachers and all adults surveyed stated that they felt closer to the children with whom they gardened (Waliczek et al., 2000). Teachers and principals are decidedly the main adult influence in a school garden and its success; however, the garden can become a burden if other adults are not brought in to assist in the program (Blair, 2009). These additional adults can come in the form of experts, such as Extension agents or Master Gardeners (Alexander et al., 1995; Patel, 1996), parents and other family members (Canaris, 1995), or community members looking to help the school and positively influence the community (Ober Allen et al., 2008). Cooperative extensions can offer expert help in how to organize and run a garden, removing some of the time requirement with

which teachers struggle (Thorp & Townsend, 2001). School gardens are a positive way to strengthen school-to-home interactions (Thorp & Townsend, 2001) and encourage greater family involvement in the school (Alexander et al., 1995). The community service aspect of the garden also extends from the school toward the community, with students able to positively impact others and develop a sense of pride through sharing what they learned with others (Dirks & Orvis, 2005) and providing food in impoverished neighborhoods (Ober Allen et al., 2008).

This community involvement greatly benefits all school members and especially those in lower economic areas. A study by Dyment and Bell (2008) showed that respondents felt that the garden was more inclusive than other areas of the school in respect to gender, class, race, and ability. This also extended to people of all ages, sexual orientations, and religions (Dyment & Bell, 2008). The garden serves as a catalyst for forming community bonds in areas that are food insecure. The food grown in the garden helps with providing food for the neighborhood, empowering students, and allowing them to have a positive impact in the community (Reis, 2015). It also brings the community together, gives them a common goal, and provides a means for adults in the neighborhood to become mentors to students, often providing support and advice to students without a strong family presence (Ober Allen et al., 2008). Cutter-Mackenzie (2009) interviewed English as a Second Language (ESL) students and their teachers who participated in a school garden to assess benefits provided by the program. Not only did the garden provide an area where students felt comfortable communicating which enhanced their English learning, but it also provided a place for teachers and students to share their cultures with each other (Cutter-Mackenzie, 2009), thus raising the cultural awareness of the teachers and students alike.

Volunteers are imperative to the success and longevity of a school garden. Lucas et al. (2018) found that travel time to a garden site and work hours inhibit parents from volunteering. They recommended recruiting volunteers at events specific to youth agricultural programs, such as a state fair, and local volunteer organizations, such as the Boy and Girl Scouts (Lucas et al., 2018). These volunteer connections lead to lasting partnerships and increased resources for the school and students (Lopez et al., 2008).

Health and Nutrition

Student health and nutrition has become a central concern among schools and families as childhood obesity continues to grow. Obesity is defined by the Centers for Disease Control and Prevention (CDC, 2019) as having a body mass index (BMI) at or above the 95th percentile for a child's gender. Using this definition, the CDC (2019) states that the obesity rate for children aged two through nineteen is at 18.5% and affects approximately 13.7 million children and adolescents. This rate is even greater in undereducated, minority, and poor urban populations (Ober Allen et al., 2008). Obesity in children causes increased health risks such as sleep disorders, orthopedic issues, and asthma, as well as the social and emotional distress that often comes from teasing and discrimination from their peers (Must & Strauss, 1999). School gardens provide an alternative learning environment in schools that may help to combat this epidemic. Students may learn concepts about health (Graham & Zidenber-Cherr, 2005), nutritious food options (Langellotto & Gupta, 2012; Robinson-O'Brien et al., 2009), new fruits and vegetables (Parmer et al., 2009), and potentially increase their physical activity (Utter et al., 2016; Wells et al., 2014). In addition to combatting obesity concerns, school gardens may also provide food to students and their families in food insecure areas (Patel, 1996) or to those facing food shortages

due to natural disasters or other negative impacts outside of the community's control (Reis, 2015).

School gardens offer a unique opportunity for schools to teach students healthy living ideals by incorporating health and nutrition into the classroom curriculum. Nutrition education in the classroom setting has been shown to be successful in increasing student knowledge of healthy living and food options (Langellotto & Gupta, 2012; Parmer et al., 2009). The addition of a school garden into nutrition education creates another dimension of learning not provided to students in a traditional classroom setting. The incorporation of the garden also leads to increased consumption of fruits and vegetables as the school garden exposes students to nutritious options they may not have otherwise tried (Ober Allen et al., 2008). A study of second-grade students showed that those students who received gardening time along with nutrition education not only increased their knowledge but were more likely to choose fruits and vegetables at lunchtime (Parmer et al., 2009). This suggests that gardening is a positive influence in student food choices. The use of produce from the garden for student snacks and lunches may also lead to a higher consumption rate of fruits and vegetables as students are excited to try what they have grown themselves (Canaris, 1995; Jaeschke et al., 2012) and have increased access to produce (Langellotto & Gupta, 2012). The garden also proved a positive influence in students choosing not to eat fast food and making healthier choices instead (Utter et al., 2016).

The outdoor time associated with gardening also adds additional physical activity that students would not necessarily receive in an indoor classroom setting. This increases student exercise (Landry & Logue, 2017) and decreases sedentary activities over time (Wells et al., 2014). This increased physical activity not only positively benefits childhood obesity but also allows students a mental break, so they are ready and able to learn while in the classroom (Lopez

et al., 2008; Patel, 1996), increases gross motor development due to the various activities, and strengthens students' muscles and bones (Wells et al., 2014). Data collected in a study of the impact of school gardens on Body Mass Index (BMI) found that there was a positive correlation between students who attended school with a garden and lower BMI (Utter et al., 2016). This study also showed that students from lower income homes received the most benefit from the garden and that the results could help to alleviate issues associated with food poverty (Utter et al., 2016).

Health benefits to students such as lower obesity rates and more nutritious food choices are just one positive aspect of school gardens that has been researched. The multiple benefits of school gardens have been well documented over the last few decades, however, there are perceived barriers that remain that can potentially impact the ability for schools to provide this positive experience to students.

Perceived Barriers

Though research has shown the benefits of outdoor time and gardening for students, the creation of a school garden requires additional resources from school faculty and staff that have not been needed previously. Required resources include time spent caring for the garden and planning, additional funding and supplies, garden curriculum, teacher training, and staffing (Blair, 2009; Dyment & Bell, 2008; Graham & Zidenber-Cherr, 2005; Jaeschke et al., 2012; Landry & Logue, 2017). These perceived barriers may prevent schools from creating a school garden program or may cause schools that energetically adopt these programs to gradually allow them to deteriorate and not become sustainable and viably useful for instruction or academic use over time.

Lack of Time and Insufficient Staffing

Although gardens present a unique learning opportunity for students in academic subjects, environmental education, and health and wellness, teachers may feel that it is a supplemental project that takes away from their already busy classroom curriculum (Graham & Zidenber-Cherr, 2005). In an online survey of 99 school gardeners in 15 states, the greatest barrier to the school garden was the lack of time, with need for additional staffing ranked next (Burt et al., 2018). If teachers are not personally energetic about the adoption or have a background in gardening, they may not use the garden or expose students to the potential learning that is available. The garden then becomes a perceived burden as opposed to a beneficial program that can assist them in instruction and provide a hands-on lab for students.

In an ethnographic study by Thorp and Townsend (2001) of an underperforming Midwestern elementary school that had a garden program, they found that the garden provided benefits, however, teachers had little time to care and maintain it because of teacher stress related to the increased focus on standardized test scores. The authors recommend utilizing community members, such as parents and garden experts, to remove the perceived time and maintenance burden from teachers. Landry and Logue (2017) found in their survey of 178 Mississippi principals that a lack of time for maintenance and upkeep is a top barrier to a school garden, while the Jaeschke et al. (2012) survey of school professionals who work with gardens showed the lack of time to affect teachers' ability to use the garden for nutrition education. A majority of the teachers who responded to the survey (87.5%) stated that they strongly agree with the statement that additional time given within the school day to have time in the garden would increase the sustainability of the school garden. The greatest barrier mentioned in Graham and Zidenber-Cherr's (2005) survey of California teachers with school gardens was the lack of time

needed to utilize it to teach students academic standards. Dirks and Orvis (2005) stated in their study of a Junior Master Gardener Program in fourteen third-grade classrooms that "Teachers may facilitate gardening activities without the ability to integrate them into existing curriculum, academic standards, and an already busy schedule. These situations often lead to frustration and ultimately the demise of school gardening" (p. 443).

Schools may need to hire additional staff or organize volunteers to maintain the gardens and take care of day-to-day tasks year-round. The addition of a garden staff person or farmer is recommended for larger gardens to remove the stress on teachers to maintain it (Thorp & Townsend, 2001). The United States Department of Agriculture (2017) recommends cooperative partnerships between school faculty and staff, non-profit organizations, community volunteers, and parents in order to keep the garden healthy and to offset the strain on school staff. A survey of 99 school gardeners from 15 states indicated that the lack of a "communication channel," or structure in place in which to communicate with the school community about garden needs, was a barrier to gaining community support and, in turn, recruit volunteers (Burt et al., 2018). The creation of a school garden committee serves to take stress off teachers by helping in decision making, maintenance, and researching funding opportunities.

Though the studies mentioned above all listed benefits to the school gardens, the lack of time perceived by teachers limits the advantages students can receive. Even with teacher buy-in and excitement for the program, if no additional time is allowed for the garden or it is not maintained properly, the program could potentially falter. The lack of necessary staffing for maintenance needs and training for teachers to help them understand how to better balance the use of a garden in their curriculum contributes to this perceived shortage of time.

Lack of Teacher Training

The perceived pressure a teacher may feel to use and maintain a school garden and the inability to incorporate these tasks into the school day is impacted by the lack of training they receive at the onset of the garden's creation, as well as continued professional development, and the school's lack of staffing for garden maintenance (Burt et al., 2018; Jaeschke et al., 2012). While schools often understand the benefits offered by a garden, they rarely plan for the needs of sustainability.

Teachers must be trained on how to use the school garden as a tool in their already busy day if a garden is to be successful. The principals in the survey conducted by Landry and Logue (2017) found that an overall lack of knowledge about school gardens adversely affected the use of the garden for academic instruction. A curriculum that can be seamlessly incorporated or professional development to train teachers on how to utilize the garden with current curriculum is a necessary step in the sustainability of the school garden. Skelly and Bradley (2000) make the following statement regarding their study of school gardens:

> teachers need to be made aware of the resources available to help them effectively integrate the garden into more classroom lessons. Integrating the garden and garden activities into classroom lessons will not only enable the teacher and the students to use the garden more, but may also enhance students' learning." (p. 231)

In a questionnaire sent to all fourth-grade teachers in the state of California with access to school gardens, a majority of the teachers stated that additional resources such as curriculum materials and training on how to incorporate the garden to current curriculum would assist in them using the garden in academic instruction (Graham & Zidenber-Cherr, 2005). Mabie and Baker (1996) studied fifth- and sixth-grade classrooms in two inner-city Los Angeles schools who completed

hands-on garden projects. Though the students showed academic growth, the authors questioned whether teachers had the training to teach science with a more experiential approach.

In her review of the benefits of school gardening, Blair (2009) states that "Teachers are the mainstay of school gardening" but must have training to effectively use the garden and support to maintain its use. Utilizing volunteers, such as community garden experts and local Extension Services, has been shown to increase administrator interest (Burt et al., 2018) and can help provide teacher training, often at little to no cost to the school (Thorp & Townsend, 2001). This training allows for greater buy-in from teachers and creates excitement about the possibilities the garden presents.

Insufficient Funds and Supplies

The cost of a garden can also be a financial burden schools may not be able to shoulder long term. Many gardens are created with grants specifically for that purpose or through established community partnerships with businesses (Skelly & Bradley, 2000). The cost of continued upkeep is something that is not often budgeted, nor are additional staffing, curriculum costs, or professional development. Unfortunately, school gardens, despite their benefits, tend to fall into disrepair without proper financial support.

Dirks and Orvis (2005) found that teachers were interested in starting a gardening program but were concerned with the cost of doing so. In the study of potential barriers to school garden integration and sustainability, Burt et al. (2018) found that a lack of overall funding is common, and schools do not know where to look or how to receive additional funding. The authors suggest developing community partnerships, applying for academic grants that may use gardening as an instructional tool, or searching for corporate sponsors as ways to overcome budgetary concerns. Often, teachers who understand the benefits of the garden and incorporate

them in their classes wind up paying their own money to keep the garden healthy and operational (Skelly & Bradley, 2000). The use of community volunteers may help to keep costs of maintenance lowered and provide opportunities for greater school-to-home connections (Thorp & Townsend, 2001). Landry and Logue (2017) found that not only is lack of funding a sustainability issue, but principals consider it a deterrent to forming a school garden program.

To overcome the funding barrier, schools must be creative in their financing approach. Options include soliciting donations for money as well as specific gardening supplies, utilizing school fundraisers, local corporations, and grants (Slow Food USA, 2013). Promoting the garden within the community also allows for sharing needs and soliciting support (Kidsgardening.org, 2017). Funds from the nonprofit school food service account can also be used to purchase supplies for the garden, such as seeds or tools if the produce is sold or used in an educational lesson (USDA, 2009). Schools may also sell the food through meals or to the school community if the money is deposited back into the nonprofit school food service account (USDA, 2009). This assists in the school garden becoming self-sustaining.

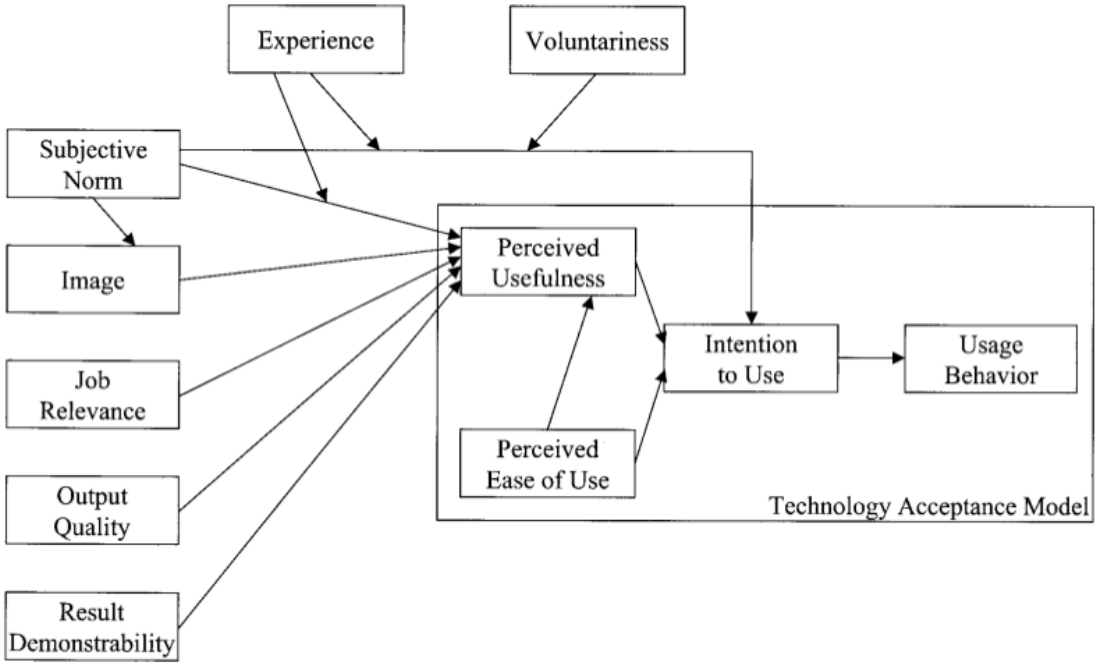
Summary and Current Research

The compilation of studies in the current literature review presents a broad representation of school gardens, their use within the school setting, and perceived benefits and barriers. Twenty of the studies are quantitative, eleven are qualitative, with six mixed-methods studies utilizing both quantitative and qualitative methodologies. The overwhelming focus of the research is on the use of school gardens and the perceived benefits, derived most often from academic testing or interviews with teachers. Of the 37 works cited, only seven focused on perceived barriers.

While the benefits of school gardens are clearly represented in current literature, less is known about the barriers to the adoption of the garden as well as how this influences the sustainability and viability of the garden long term. This study seeks to further this understanding by utilizing Venkatesh and Davis's (2000) Extended Technology Acceptance Model (TAM2), which was created to study and better understand the causes influencing the adoption of technology (see Figure 2).

Figure 2

Extended Technology Acceptance Model (Venkatesh & Davis, 2000, p. 188)



The TAM2 is an extension of the Technology Acceptance Model (Davis, 1989; Davis et al., 1992) created to understand technology user acceptance and usage. Davis (1989) pointed to the fact that corporations were studying users' subjective reactions throughout the designing of new technologies with little concern for the validity of the reactions or the outcomes of usage behavior. He therefore set out to find better measures for actual technology usage. The Technology Acceptance Model (TAM) operates on the theory that two beliefs, perceived

usefulness and perceived ease of use, determine a user's intention to use and behavior of use. Perceived usefulness is defined as "the extent to which a person believes that using the system will enhance his or her job performance" and perceived ease of use is "the extent to which a person believes that using the system will be free of effort" (Davis, 1989, p. 320). Both measures are subjective and may or may not agree with objective assessments, however, Davis stated that they were more important in adoption and usage. Perceived usefulness was shown to more greatly influence whether an employee would use a technology than ease of use would. Without a technology proving to be useful, the perceived ease of use would be a nonfactor. Thus, Davis showed the chain of causality of ease of use > usefulness > usage (1989).

The TAM2 further expanded this idea by detailing external and internal variables that affect the perceived usefulness of a technology. These variables are defined as the following:

Subjective Norm: The assumed pressure and opinion of others that influence use of technology

Image: The potential boost in status from adopting and using the new technology

Job Relevance: The relevance of the technology to the job needing to be performed

Output Quality: The quality of work performed using the technology

Result Demonstrability: The ability to show the results of the adoption of the technology

Subjective Norm also influences the intention to use the technology, as the opinion of those around a person as well as those in higher positions can cause someone to use a technology more readily.

Two variables impact subjective norm and the perceived usefulness as well as the intention to use the technology:

Experience: A person's background with the introduced technology

Voluntariness: The perceived voluntariness of the adoption of the technology, whether it is mandatory or voluntary

The TAM2 has been used in research to detail technology and software adoption in various settings. Casas (2010) researched individual's acceptance and intention to use financial retirement software. The study modified the TAM2, removing the three inputs that were felt to not apply to this study: voluntariness, experience, and job relevance. The data collected showed that perceived usefulness, perceived ease of use, and subjective norm were the determining factors retirees pointed to in their potential use of the financial software. The TAM2 has also been used to determine online website use. In a study of Web 2.0 sites, which are characterized by sharing and participation by users, the TAM2 was used to understand user intentions and behavior so they could better detail their websites to gain more users (Wu et al., 2011). The research showed that Web 2.0 users valued higher interactivity and saw that as perceived usefulness in accordance with the TAM2. The information gained from this study served to build a resource for new business ventures on the Internet.

The medical field has also been an area of interest for using the TAM2 in technology adoption. As the healthcare arena has moved towards more internet-based health applications (IHA) to increase efficiency and reduce errors in record and billing, studies have been conducted to find what influences healthcare workers' use of an IHA. Chismar and Wiley-Patton (2002a) studied the TAM2 to determine if it was an appropriate tool to use in the medical area. They received data from eighty-nine surveys completed by practicing pediatricians in Hawaii. The collected data showed that perceived usefulness of the IHA had a significant influence on the doctors' willingness to use the technology, however, the perceived ease of use had no significant

impact on its use. Previous studies of IHA usage explained that the perceived ease of use may not apply as prevalently with physicians as they have a higher level of cognitive competency and adaptability to new technologies (Hu et al., 1999).

In education, the TAM 2 has mostly been used in higher education to determine technology adoption and use in classes as well as in distance learning. Garcia-Ruiz et al. (2018) surveyed students in an undergraduate computer science class about the use of a microcontroller board in projects completed in class. The students found the technology to be easy to use (perceived ease of use) and useful (perceived usefulness) and stated they would continue to use the technology outside of the classroom. The use of social media in teaching has also been viewed through the TAM2 (Acarli & Saglam, 2015) as well as an online assessment method (Cigdem & Oncu, 2015). As online classes continue to become more common, researchers have utilized the TAM2 to determine students' perceptions of technology and its ease of use (Naarmala, 2004; Venter et al., 2012). Kushatmaja and Suryani (2019) specifically focused on the adoption of Edmodo, an online education platform, in the university setting. An online questionnaire sent out to current students showed that perceived usefulness was the determining factor of using Edmodo for class purposes.

Venkatesh and Davis (2000) posit that these variables directly and indirectly influence the intention to use a new technology as well as the actual behavior and use. For the current study, the school garden is considered a technology, a manner of accomplishing a task especially using technical processes, methods, or knowledge, used by teachers in an educational setting for the benefits of students. The current study points to the fact that it is interchangeable with technology that is being adopted in a workplace setting in the TAM2.

By better understanding the variables influencing teacher adoption of the school garden, perceived barriers, and the effect of time and experience, this study seeks to discern what supports school gardens need to ensure sustainability or what potentially shortens their life in the school setting. This understanding then allows for schools to adjust how school gardens are adopted, leading to a higher level of sustainability and success.

Chapter 3: Methods

Introduction

The use of school gardens in student instruction has been present in the United States since the late 1800s (Subramaniam, 2002), however, little research was conducted to study the effects of this outdoor learning environment until much later. Current research shows that school gardens offer great benefits to students who have access to them (Blair, 2009). With the implementation of the gardens, research has also shown that there are barriers to using the garden during the school day, such as a lack of time and money and little training for teachers (Burt et al., 2018). The increased number of schools seeking to invest in gardening spaces shows that research must be conducted on what is needed to make school gardens sustainable to increase student benefits and also prevent schools from spending time and money on a failed curriculum tool.

The Extended Technology Acceptance Model, or TAM2, serves as the theoretical framework for this study. Originally created to determine technology user acceptance and usage (Venkatesh & Davis, 2000), the TAM2 serves to help better understand the usage of the school garden through teacher beliefs of perceived ease of use and perceived usefulness of the garden. According to Venkatesh and Davis (2000), these two factors directly influence the use of the technology, in this study, the school garden.

This chapter will present the design and research questions of the current study, the participant criteria and recruitment, the measurement tool used, and how data was collected. It will conclude with the analysis methods utilized to code the assembled data.

Design

As introduced in Chapter 1, the purpose of this elicitation study was to ascertain a teacher's attitudes and beliefs toward his or her school garden and to determine the elements that affected a teacher's perceived usefulness of the school garden and its perceived ease of use. An elicitation study was the chosen method in which this information would be determined. An open-ended survey (Table 1) was created based on the elements featured in the theoretical framework of the Extended Technology Acceptance Model (Venkatesh & Davis, 2000). Each element that helped to influence a teacher's perceived usefulness and perceived ease of use in relation to the school garden was directly addressed within the survey. An elicitation study allows for better understanding of the teachers' views on the school garden and what influences the perceived usefulness and ease of use of the school garden. Elicitation studies can gather communal terminology from the teachers who have used or continue to use a school garden and to collect information from teachers who are and are not using a garden for student instruction (Fishbein & Manfredo, 1992). It also allows for viewpoints from differing populations of teachers, such as those who teach in varying socio-economic settings or have differing levels of experience in a school garden. This elicited vocabulary and terminology will be used to inform future research and allow for professional development or training to be better tailored to the unique needs of teachers who have access to a school garden (Middlestadt et al., 1996).

Research Questions

This study sought to answer the following research questions:

1. What do teachers report relates to their use of the school garden?
2. How do the attitudes and beliefs of teachers with successful gardens differ from those with unsuccessful gardens?

3. Does a teacher's perceived usefulness of the school garden seem to relate to their frequency of use?

Participants

The participants were a group of teachers in the United States whose school has had a school garden within the past five years or currently has a school garden of which they have access. Social media, to include but not limited to Facebook, Instagram, and Twitter, was the distribution method of choice to reach the 100 (minimum) teachers needed for the survey. Social media groups pertaining to school garden were researched and the link for the survey was distributed directly to those members to recruit participants with a school garden background. Examples of the social media groups included state offices that oversee school gardens, extension offices, 4-H programs, and relevant school programs such as Future Farmers of America. The advertising services for each of the social media sites that offer this service as well as relevant hashtags such as #schoolgarden were also used to allow for a wider distribution of the survey. In a study of 110 medical research studies that used Facebook, a popular social media app, for recruiting showed that using Facebook offers a similarly representative sample as those recruited through traditional methods, offers access to participants who would otherwise be difficult to reach, and is faster and more cost effective than traditional methods (Thornton et al., 2016). The criteria for selection included:

1. Teachers who have access to and use social media
2. Teachers in the United States at any grade level, prekindergarten through 12th grade
3. Teachers who teach or have taught at a school with a school garden within the last five years

The sample size in elicitation studies is not determined by a set number. The main consideration in this determination is the saturation of the studied concept. Saturation is defined as "the point in the qualitative data collection process when little or no new relevant or important information emerges and collecting additional data will not add to an understanding of the participant experience of a concept" (Turner-Bowker et al., 2018, p. 839). This point of saturation of the concept is considered the point an adequate sample size is reached.

In a study of estimation of saturation and sample size in qualitative concept elicitation, Turner-Bowker et al. (2018) evaluated 26 elicitation interview studies to determine the point of saturation. They posit that 85% of all concepts are elicited after 10 interviews, more than 90% after 15 interviews, and more than 95% after 20 interviews, and 99% by 25 interviews (Turner-Bowker et al., 2018). Though the study focuses on elicitation interviews, open-ended questionnaires and surveys are considered direct methods of knowledge elicitation, a similar methodology as interviews (Cooke, 1994). Guest et al. (2006) found that a sample of 12 would likely be sufficient to determine shared beliefs, perceptions, or behaviors in a homogenous sample.

Though studies have sought to quantify this for validity's sake, studies on the saturation of elicitation research vary dependent on the sample participating and the emergence of themes. The achievement of saturation is of utmost importance and can differ from study to study. For this elicitation study, 99 surveys were collected due to the number of elements in the TAM2 being analyzed and to ensure a common vocabulary emerged from the participants that could inform later research. With the goal of connecting this data to future studies, the larger quantity of answers helps to determine the prevailing belief among teachers and allows for future studies to design measurement tools with the language teachers used in this study. Since research has

shown that open-ended questions are more likely to be skipped in a survey than a question with pre-selected answers (Reja et al., 2003), the 31 open-ended elicitation questions, after the quantifying first question of the survey used to determine if the teacher has access to a school garden or did at some point in the last five years, were presented to participants in random order. The larger pool of participants was facilitated through social media to reach participants with selected criteria.

Measures

The Extended Technology Acceptance Model or TAM2 (Venkatesh & Davis, 2000) is the theoretical framework on which the open-ended survey for this study is based. The Technology Acceptance Model (TAM), the original model created by Davis (1989), was originally created to determine the adoption of technology and usage. The TAM2 added additional elements to the original model that shows outside factors that directly influence the perceived usefulness and perceived ease of use of new technology. The TAM2 was widely used to determine technology usage with the adoption of new technology (Wu et al., 2011; Wingo et al., 2017; Chismar & Wiley-Patton, 2002b), however, this study substitutes the school garden as the technology or tool being adopted and utilized.

The elicitation survey used open-ended questions to better ascertain participants' attitudes and beliefs pertaining to the school garden. The collection of open-ended data allowed for a richer dialogue, the emergence of themes, and a common vocabulary. The study used the TAM2 as a map to help determine the layout of the survey as well as direct the development and wording of the surveys. The survey contains 4 questions to elicit the participant's experience with a school garden and 27 questions related to the elements that influence the perceived usefulness and perceived ease of use of the school garden (see Table 1).

The survey was piloted with 7 educators in July 2020 to gain feedback on the clarity of the terminology used in the questions and the length of the survey. All respondents indicated that the questions were clear and easy to understand, however, the length of the survey was cited as a concern. Each question is aligned to the TAM2 and seeks to elicit information that will inform the research questions. The length of the survey will affect attrition, so all questions after the first demographic question have been randomized to allow for adequate saturation of all questions.

Table 1

Open-ended Survey Questions Used in the Present Study

For this survey, a school garden is defined as a location, most often outside, where students can spend time experimenting and exploring while learning curriculum standards. This location may be a large area or a small patch of land.	
Participant Experience	• Does your school currently have a garden or has it had a garden in the past five years while you were employed there? *If the teacher replies no, the survey will remove them at this point. • In what state is your school located? • If your school currently has a garden or has had a garden in the past five years, how long has/had it been operating and in use? • If your school currently has a garden or had one in the past five years, approximately how often do/did you use it with students?
Experience	• What roles have you held in your school within the last five years? If you are a teacher, please list all subjects that you teach or have taught in the past five years at your current school. • How many years have you been in your current role? • How many years total have you worked in schools?

	• What experience do you have with school gardens? • What experience do you have with gardening outside of school?
Subjective Norm	• How does your school administrator(s) view the use of the school garden? • What is the stance of the school district on the use of the school garden? • Who within your school and/or district supports the use of the school garden? • Who within your school and/or district opposes the use of the school garden? • What is your view on the use of the school garden?
Image	• How do people in your school describe or talk about teachers who use the school garden? • What influence does the garden have on how the community views the school?
Job Relevance	• How does the school garden relate to the classes and curriculum you teach?
Output Quality	• How does the school garden affect students' learning in your classes?
Result Demonstrability	• What, if any, do you believe are the benefits of using the school garden? Please explain any benefits. • What, if any, do you believe are the barriers of using the school garden? Please explain any barriers.
Voluntariness	• Is garden use voluntary or mandated in your school? • Who decides if teachers are required to use the school garden? • Approximately what percentage of teachers do you believe utilize the garden at your school? • How is the garden used in other ways besides instruction?
Perceived Usefulness	• What is the usefulness of the school garden in instruction and student learning, if any?

	• What is the usefulness of the school garden beyond instruction and student learning, if any? • Does the garden increase your effectiveness as a teacher and if so, how?
Perceived Ease of Use	• How easy is it to use the garden in student instruction? • How difficult is it to use the garden in student instruction? • What training did you receive on how to best use the school garden with students? • Approximately how much time was spent in training teachers on how to best use the garden at your school?

Participants were recruited through social media to receive the open-ended survey. The participant experience question determined whether the teacher answering the survey met the criteria of having had access to a school garden within the last five years in his/her teaching career. If the teacher indicated positively that they have or have had garden access within the specified time frame, they were directed to complete the remaining questions. If they responded negatively, the teacher was then finished with the survey.

Data Collection

The data collection occurred electronically through Qualtrics. The survey was created in Qualtrics and distributed using social media, allowing for a wider sample and easier retrieval. The data was collected beginning in November of 2020 and was completed in February of 2021. Once the survey was created in Qualtrics, the participants were recruited through social media. These participants could access the survey through a link provided. The participants were further narrowed down to those with access or those who have had access to school gardens within the last five years with questions detailing teaching experience. The survey was completed

anonymously, and no identifying data was received with the survey. Data collection was complete in February of 2021. A total of 114 surveys were collected, with 99 meeting the criteria of teachers in the United States who have or have had access to a school garden within the given time frame.

Analysis

This elicitation study collected 99 open-ended surveys from teachers in the United States who have had access to or are currently working where there is a school garden. Using In Vivo Coding, the data collected electronically through Qualtrics was coded and then mapped to determine categories from the initial codes. The use of In Vivo Coding offers a unique look at the data collected in this study.

In Vivo Coding uses the participants' words as the code, preserving the meaning and intent of their statements (Charmaz, 2014). Strauss (1987) explains that In Vivo Coding has two characteristics: analytic usefulness, allowing for a specific meaning, and imagery, allowing the reader to hear the participant's voice and more clearly understand his or her meaning. The use of In Vivo Coding in this study allows the experience of the teachers to be communicated in their own words and allows for future research to use the emergent vocabulary and terms.

Once the initial coding has taken place, the entirety of the codes were listed during the first iteration of code mapping. The second iteration of code mapping took these codes and sorted them into categories. These categories were then condensed into central themes or concepts in the third iteration (Saldaña, 2016). These were the higher-level concepts that were presented as findings at the conclusion of the study.

During coding, reflexivity was utilized to ensure trustworthiness of the research findings. All researchers have biases that they bring into their research. This is not considered a negative

as long as researchers understand how their backgrounds may influence the analysis of the data (Schwandt, 2015). Reflexivity is critical self-reflection on personal reactions to better understand any preconceived viewpoints, allowing clarity about how the researcher may view data (Josselson, 2013). A journal was kept throughout the collection and analysis of data in this study to allow the researcher to reflect upon personal positions that might influence coding. Keeping a journal throughout a qualitative study is considered to be a way for researchers to understand how their viewpoints, thoughts, and feelings may influence findings and lends trustworthiness to the study (Carlson, 2010; Josselson, 2013).

Positionality

In qualitative research, the positionality of the researcher is important in understanding the data and its analysis. Researchers cannot remain impartial and neutral but instead bring their background and an understanding to research that may add more insightful analysis (Moser, 2008). I am a forty-six-year-old white female Ph.D. student at Auburn University seeking a degree in the Administration of Curriculum and Instruction. I have taught elementary and middle school grades in a public school, several independent schools, and one international school. Due to my spouse being in the military, I have taught in multiple locations throughout the country and once overseas. I am currently the middle school principal at an independent school in Montgomery, Alabama.

In my previous position as the elementary science lab teacher at my current school, I started a school garden initiative and served on the planning committee. Our school is in the process of building a hoop house and garden area with hopes to have the garden operational and ready for instruction as of Fall 2021. The funding was quickly received, but the construction has been challenging.

Though I have not worked at a school with a garden, my background as a classroom teacher gives me insight into the benefits that a garden offers teachers and how it can be used in instruction. I can also see that there would be possible constraints and difficulties on teachers using it if training and planning has not taken place for day-to-day operations.

Chapter 4: Analysis

The purpose of this elicitation study was to ascertain a teacher's attitudes and beliefs associated with the school garden and how this influences the success of that garden. The open-ended survey was used to elicit terminology these teachers use in relation to school gardens and allow for them to share their experiences and ideas about school gardens. Using elicitation techniques, this study sought to answer the following research questions:

1. What do teachers report relates to their use of the school garden?
2. How do the attitudes and beliefs of teachers with successful gardens differ from those with unsuccessful gardens?
3. Does a teacher's perceived usefulness of the school garden seem to relate to their frequency of use?

While much research has been conducted on school gardens and their benefits and barriers, teacher attitudes and beliefs about school gardens and how that influences the success of the program has not been adequately studied. The open-ended survey used in this study sought to advance the understanding of teachers who work in schools with gardens, gather vocabulary and terminology specific to the participants, and shed light on the success and sustainability of these gardens through emergent themes.

Demographics

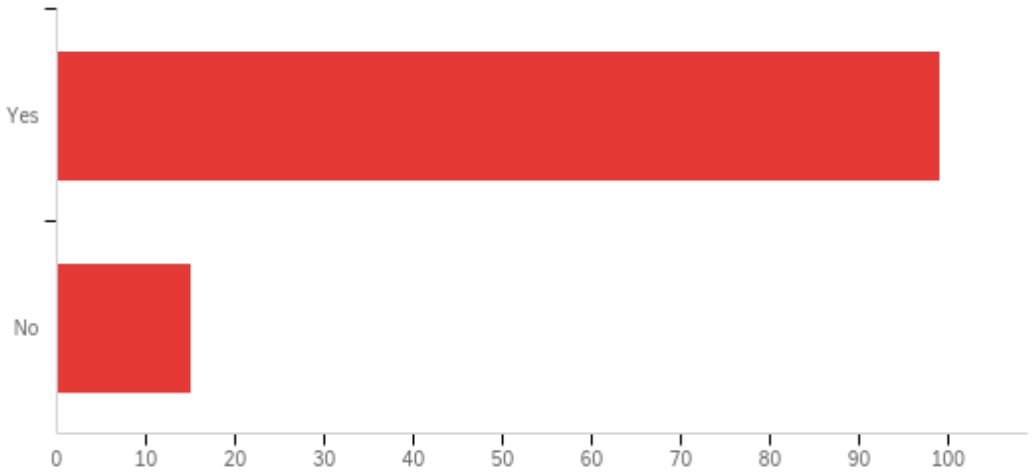
The sample for this elicitation study was teachers who currently teach or have taught in schools, prekindergarten through 12th grade, with gardens within the last five years. The participants were recruited through social media using advertising, hashtags of relevant gardening programs, and social connections. A total of 114 people started the survey with 15

(13.16%) being eliminated after the first question since they do not currently have access to a school garden or have not taught at a school with a garden within the last five years.

Figure 3

Survey Participants and School Garden Access

Does your school currently have a garden or has it had a garden in the past five years while you were employed there?



With the large number of open-ended questions on the survey, the remaining 99 participants (86.84%) answered a varying number of questions. The randomization of survey questions insured a more balanced number of responses for each question and allowed for adequate saturation of all questions. The average number of responses for each question is 63.3 answers (58 low, 69 high).

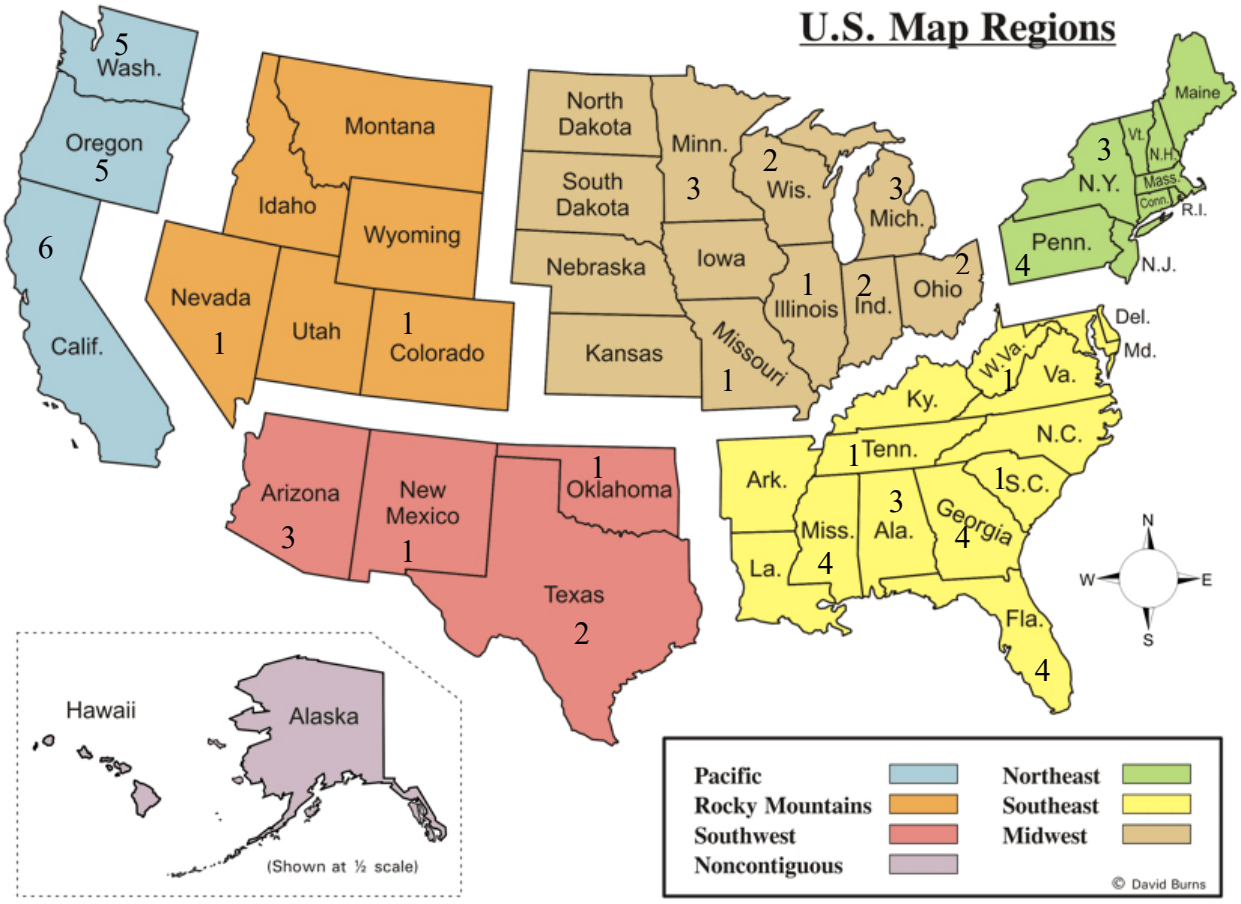
The initial goal of 100 survey responses was not reached. Saturation was, however, considered to be reached through an analysis of the data. Saturation is the main consideration in data collection in qualitative research and is defined as "the point in the qualitative data collection process when little to no new relevant or important information emerges and

collecting additional data will not add to an understanding of the participant experience of a concept" (Turner-Bowker et al., 2018, p. 839). To determine if saturation had been reached in the data, 25 participant responses were selected randomly using a random number generator. Those 25 responses were studied for each question and answers were aggregated into common themes and ideas. Once that was completed, the same was completed with the remaining answers for each question. These themes were compared with the first set to determine if any new relevant information had emerged. It was determined that no new information had emerged in the second set of data and therefore that saturation had been reached. The data for 99 participants who answered positively that they have or have had access to a school garden within the last five years was then analyzed in relation to the three research questions.

After the first survey question that eliminated participants who do not teach at a school with a garden or have not taught at a school with a garden within 5 years, there were three additional questions to gather participant experience with school gardens. These questions asked the state in which the school is located, how long the school garden has or had been operational, and how often the participant uses or used the school garden with students. Participants represent schools in 26 states. Figure 4 shows the states represented with the number of respondents from each state.

Figure 4

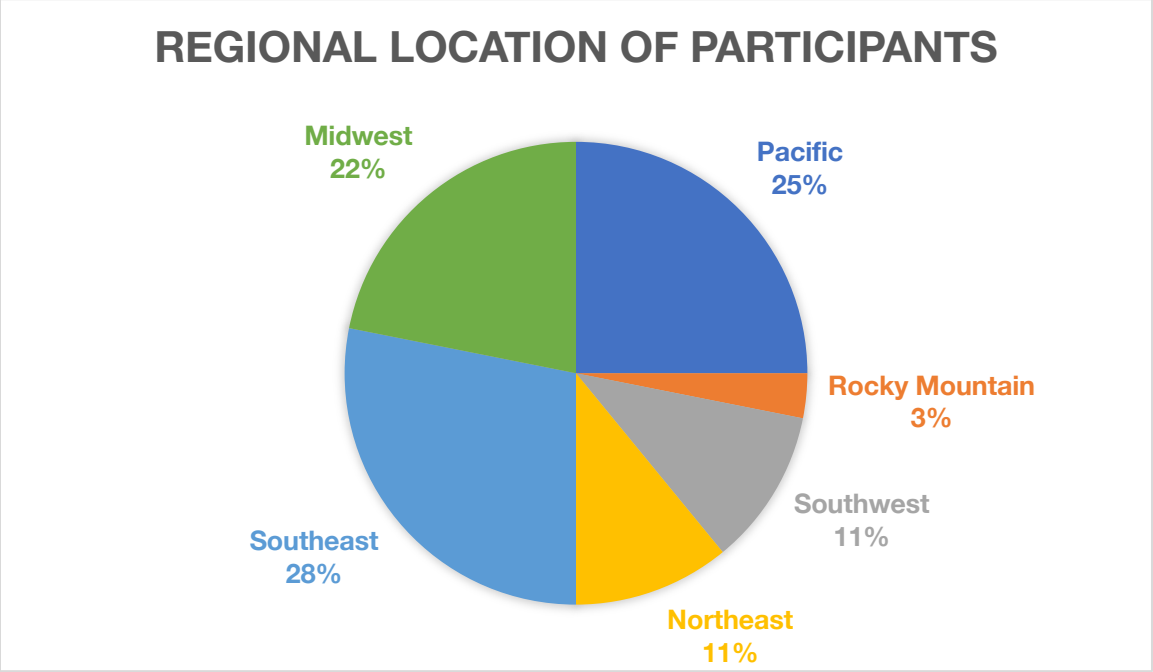
NEXTSTL (Ihnen, 2017, retrieved from https://nextstl.com/2013/07/mental-map-of-the-midwest-from-st-louis/



The map is divided by regions to show the regional representation, as well. Of the 64 respondents, 18 (28%) were from the Southeast, 16 (25%) were from the Pacific region, 14 (22%) were from the Midwest, 7 (11%) were from the Southwest, 7 (11%) were from the Northeast, and 2 (3%) were from the Rocky Mountains as referenced in Figure 5.

Figure 5

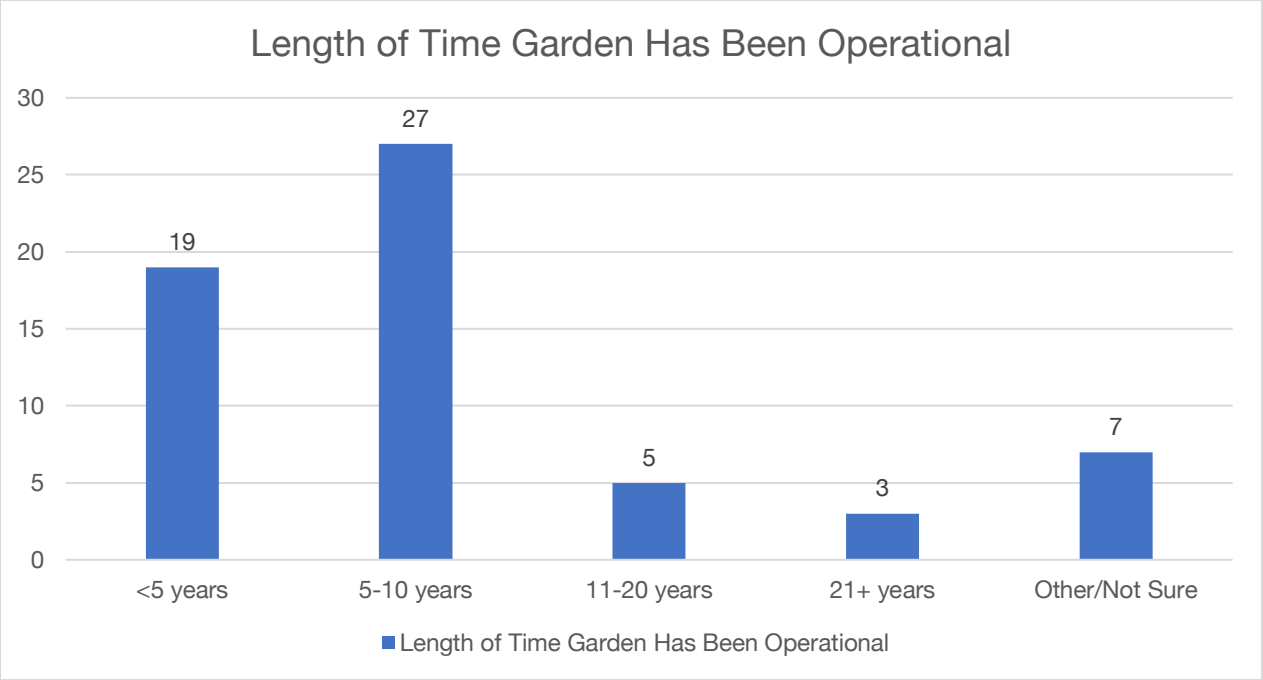
Regional Location of Participants



Participants reported they have or have had access to school gardens for varying amounts of time. The operational time of the school gardens represented indicated that 19 (31.15%) were operational less than 5 years, 27 (44.26%) were operational 5 to 10 years, 5 (8.20%) were operational 11 to 20 years, 3 (4.92%) were operational 21 or more years, and 7 (11.48%) were not sure of the length of time the garden had been operational (Figure 6).

Figure 6

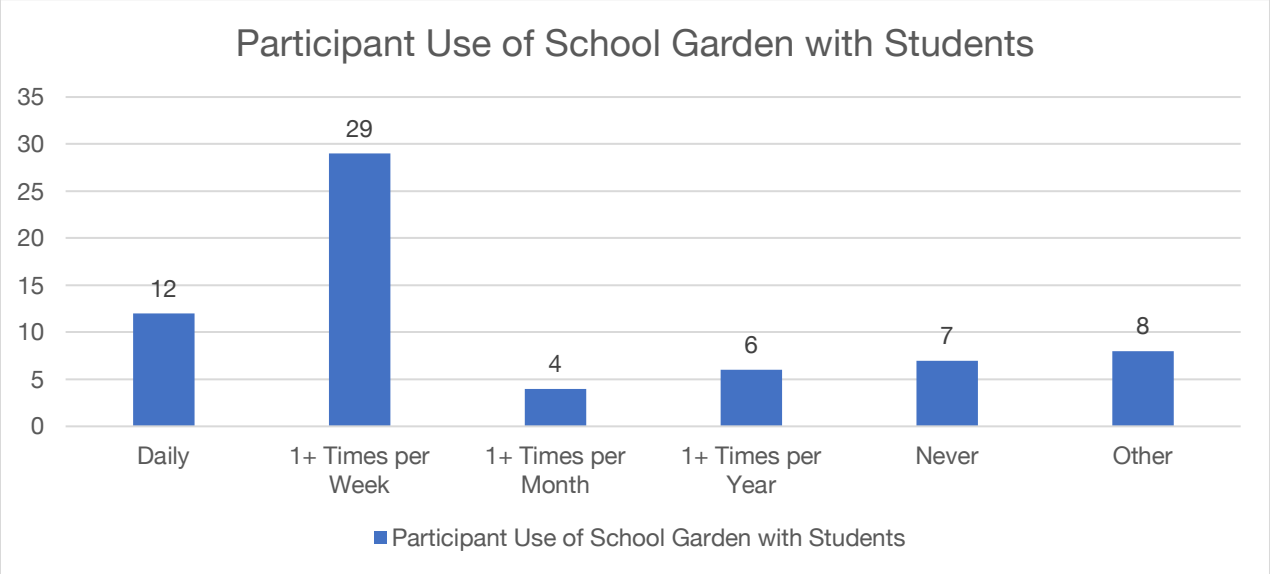
Length of Time Garden Has Been Operational



In one open-ended question, the participating teachers reported how often they used the school garden with students. Figure 7 breaks down this data: of the 66 respondents, 12 (18.18%) teachers used the garden daily, 29 (43.94%) used the garden one or more times a month, 6 (9.09%) used the garden one or more times per year, 7 (10.60%) never used the garden, and 8 (12.12%) did not have a quantifiable response.

Figure 7

Participant Use of School Garden with Students

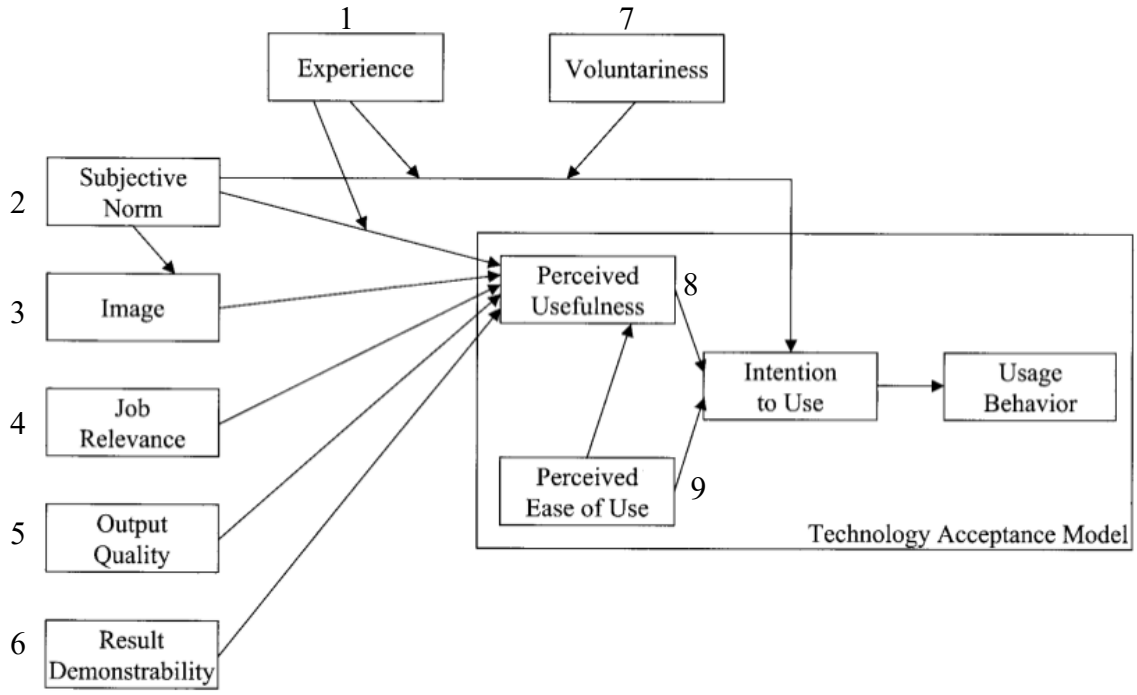


Results

The Extended Technology Acceptance Model (TAM2) by Venkatesh and Davis (2000) was created to better understand the adoption of new technology and how that influences usage behavior. There are seven internal and external variables defined in this model that relate to the perceived usefulness of a technology: Subjective Norm, Image, Job Relevance, Output Quality, Result Demonstrability, Experience, and Voluntariness (Figure 8). Each of these variables informed specific survey questions and were numbered in Figure 8 for organization of the results.

Figure 8

Extended Technology Acceptance Model (Venkatesh & Davis, 2000, p. 188)



Research Question One

The first research question sought to determine what teachers report relates to their use of the school garden. In the TAM2, each of the seven variables influencing the Perceived Usefulness and the Perceived Ease of Use have a correlation to the Intention to Use which leads to Usage Behavior. These seven variables shown in Figure 8 informed the remaining twenty-six open-ended questions on the survey.

In analyzing the data, the responses were viewed by question, with the entirety of the answers for each question analyzed independent of the participants other responses. The data was then disaggregated to learn more about the respondents in relation to the TAM2 variables. Each variable is defined below, and the data in relation to each question is discussed.

1. Experience

Experience in the TAM2 is defined as a person's background with the introduced technology (Venkatesh & Davis, 2000), which in this case is the school garden. It influences the intention to use as well as the perceived usefulness of the technology. The survey included five questions that referenced the teachers' experience with school gardens.

The first of these questions asked, "What roles have you held in your school within the last five years?" As shown below in Table 2, the survey participants have held varying roles. There were sixty respondents, however, some participants have held multiple roles within the last five years, thus the disparity in the number of responses in comparison with the number of respondents. The response count indicates the number of times that role is mentioned in the responses while the response percent is the percentage of the total responses.

Based on the collected data, a majority of the participants were teachers, with 35.62% being elementary teachers, 16.44% middle school teachers, 9.59% high school teachers, and 8.22% preschool or prekindergarten teachers. The next highest percentage (4.11%) was from teachers who have recently retired. The remainder of the respondents were from varying positions that would have access to school gardens.

Of the participating classroom teachers, most elementary teachers were teaching all academic areas. The middle and high school teachers mostly taught science (mentioned 11 times) with math (4), English (1), art (1), and music (1) all receiving mentions.

Table 2

Roles Held in School Within the Last Five Years

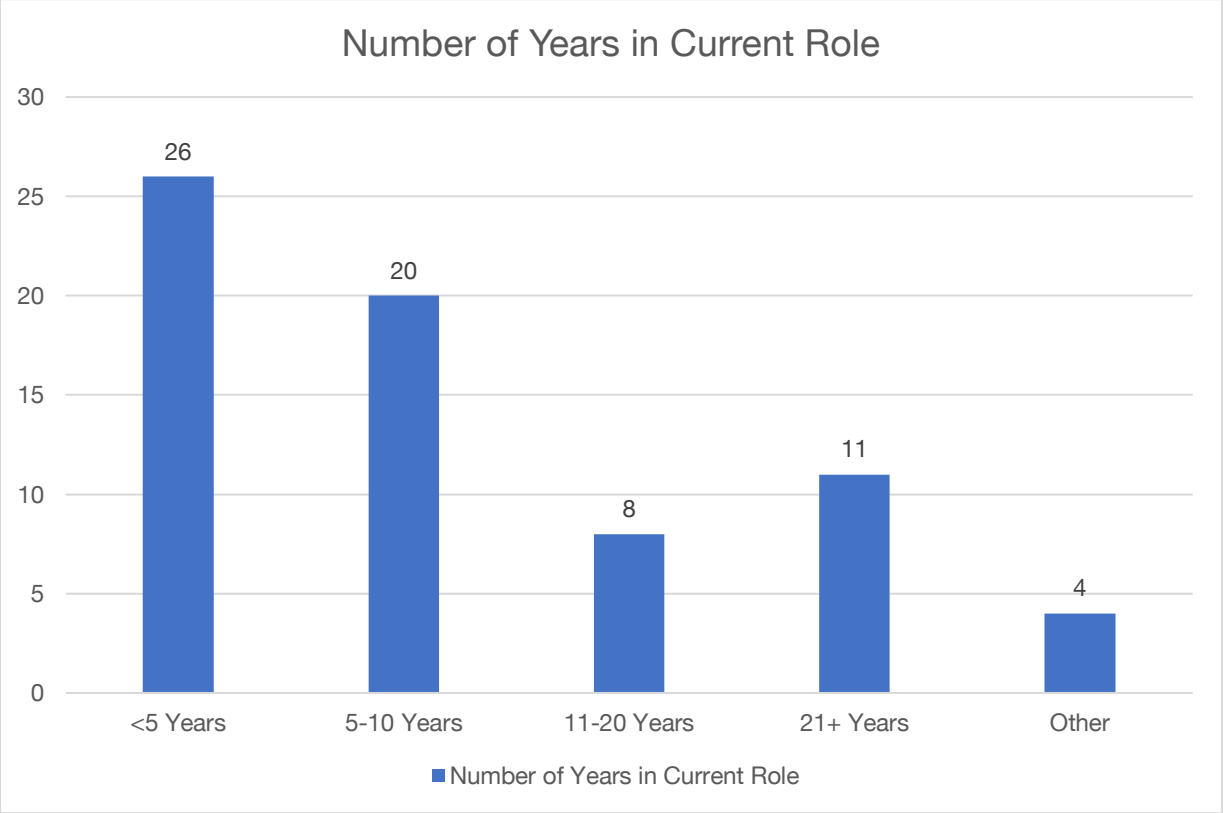
Roles	Response Percent	Response Count
Teacher – Elementary School	35.62	26
Teacher – Middle School	16.44	12
Teacher – High School	9.59	7
Teacher – Preschool/PreK	8.22	6
Retired	4.11	3
Teacher – Special Education	2.74	2
Farm Worker	2.74	2
Librarian	2.74	2
Paraprofessional	2.74	2
Principal	1.37	1
After School Coordinator	1.37	1
Social Worker	1.37	1
Speech Language Pathologist	1.37	1
Teacher Assistant	1.37	1
Teacher – English Language	1.37	1
Garden Coordinator	1.37	1
Other	5.48	4

Note. Participants may have held multiple positions within the five-year period.

The second question about the participants' experience asked, "How many years have you been in your current role?" There were 69 responses with 26 (37.68%) having been in their current role for less than 5 years, 20 (28.99%) for 5-10 years, 8 (11.59%) for 11-20 years, 11 (15.94%) for 21 or more years, and then 4 (5.80%) answers that were not quantifiable (see Figure 9).

Figure 9

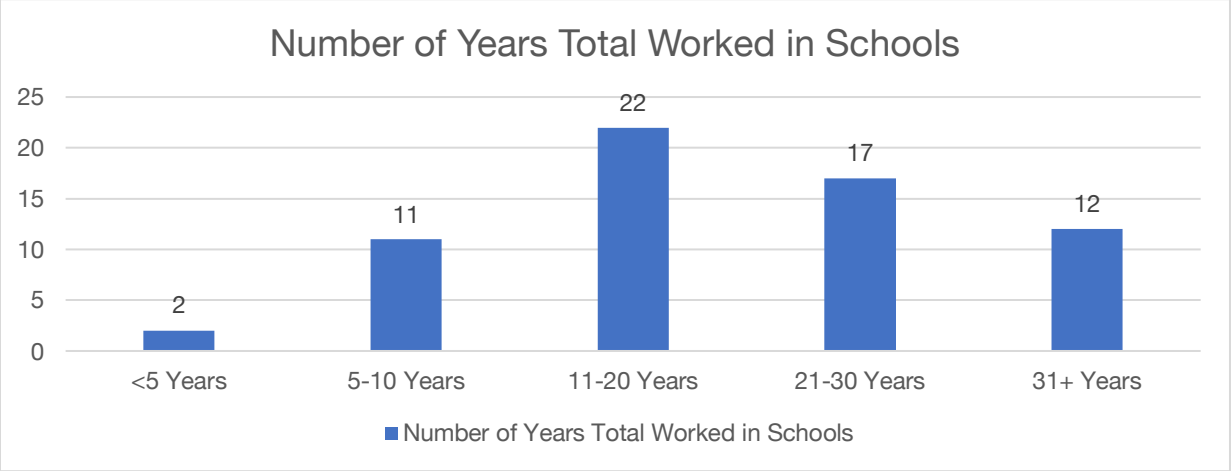
Number of Years in Current Role



The third question about experience asked, "How many years total have you worked in schools?" The amount of time the participants had worked in schools varied from less than 5 all the way to over 31 years, a majority of the participants having worked in schools for 11-20 years. Of 64 responses, 2 (3.13%) had work in schools for less than 5 years, 11 (17.19%) for 5-10 years, 22 (34.38%) for 11-20 years, 17 (26.56%) or 21-30 years, and 12 (18.75%) for 31+ years (see Figure 10).

Figure 10

Number of Years Total Worked in Schools



The fourth question having to do with participant experience asked, "What experience do you have with school gardens?" This question begins to narrow the data down from experience in schools to their experience directly with school gardens. The 58 participant responses were organized in four levels of experience: 24 (41.38%) created or are in charge of the garden, 20 (34.48%) use the garden for instruction of students and/or maintain the garden, 12 (20.69%) reported this was their first experience with a school garden, and 2 (3.45%) had nonquantifiable responses (see Table 3).

Table 3

Participant Experience with School Gardens

Level of Experience	Response Percent	Response Count
Created/in Charge of Garden	41.38	24
Teaching Students/ Maintaining Garden	34.48	20
Current Garden is First Experience with School Gardens	20.69	12
Other	3.45	2

The final question about experience asked, “What experience do you have with gardening outside of school?” As shown below in Table 4, the 67 respondents overwhelmingly had experience with gardening outside of the school setting: 54 (80.60%) currently have or have had a home garden or farm, 11 (16.42%) were involved in a gardening program such as Master Gardener, and only 2 (2.99%) respondents had no experience with gardens outside of school.

Table 4

Participant Experience with Gardens Outside of School

Level of Experience	Response Percent	Response Count
Home Garden/ Farm	80.60	54
Gardening Program (Master Gardener, Community Garden, Garden Club, etc.)	16.42	11
None	2.99	2

2. Subjective Norm

In the TAM2, subjective norm refers to the assumed pressure and opinion of others that influence the use of the technology (Venkatesh & Bala, 2008). The subjective norm influences the intention to use, the perceived usefulness of the technology, and the image or status boost thought to be achieved from using the technology. The survey included five open-ended questions about subjective norm in relation to the school garden.

The first question asked, “How does your school administrator(s) view the use of the school garden?” Of the 61 responses, a majority of the administrators (68.85%) had a positive view of the garden, 14.75% had a mixed opinion, 6.56% had a negative opinion, and 6.56 had no opinion (see Table 5).

While most administrators appreciate the garden, the reasons mentioned why administrators did not like the garden included that it was an “eyesore” and became unsightly when not maintained. The perceived lack of educational value by the administration was also

commented on multiple times. One respondent stated that his/her school administrator was "only concerned about raising test scores," while another mentioned the school garden was considered "time away from learning." Several respondents stated that their administrators were not involved with the garden at all or that it "was not high on their priority list."

Table 5

Administrator View of School Garden

View	Response Percent	Response Count
Positive	68.85	42
Mixed Opinion	14.75	9
Negative	6.56	4
No Opinion	6.56	4
Other	3.28	2

Note. Other indicates responses that did not focus on administration's view of the garden.

The second question about subjective norm asked, "What is the stance of the school district on the use of the school garden?" This question enlarged the area being viewed to include superintendents, school boards, and other school officials. Respondents reported over half (57.14%) of the school districts represented had a positive stance on the school garden. Only 1 participant (1.59%) stated that his/her district had a negative stance. Approximately one fifth (20.63%) explained that their district had no stance, or they are unsure. There was a significant private school representation (15.87%) that had no school district (see Table 6).

Table 6

School District Stance on School Garden

Stance	Response Percent	Response Count
Positive	57.14	36
Negative	1.59	1
No Stance/ Unsure	20.63	13
No School District (Private)	15.87	10
Other	4.76	3

Note. The other represents participants who stated not applicable or gave other information about their school district.

Question three on subjective norm asked, “Who within your school and/or district supports the use of the school garden?” There were 65 participants who answered this question on the survey, but some gave multiple answers. The response count in Table 7 indicates how many time each group was mentioned. The greatest number of those who support the garden are administration (28.40%), teachers (22.22%), and everyone (22.22%). Community (12.35%), school support staff (6.17%), and “me” (2.47%) were also represented in the responses. A smaller number of participants were unsure (4.94%) of who supports the garden and 1 respondent stated no one shows support (1.23%).

Table 7

People Within the District Who Support the School Garden

Group	Response Percent	Response Count
Administration	28.40	23
Teachers	22.22	18
Everyone	22.22	18
Community (Families, PTA, Clubs)	12.35	10
School Support Staff	6.17	5
Me	2.47	2
Unsure	4.94	4
No one	1.23	1

Note. Some respondents gave multiple answers.

Question four in the subjective norm section asked the opposite, “Who within your school and/or district opposes the use of the school garden?” Of the 63 responses, 44 participants (69.84%) stated that no one opposed the garden in their school and/or district. Of those who do have opposition within their school and/or district, they gave owner or administration (14.29%), support staff (6.35%), and teachers (1.59%) as their responses while 4 participants (6.35%) were unsure (see Table 8).

Of those who did oppose the garden, the administrators mentioned opposed it because they felt it did not beautify the campus and/or it took away from instruction. The support staff

who opposed the garden was mostly school maintenance and janitorial workers who thought it added work to their daily schedule for the upkeep such as mowing and putting tools and supplies away.

Table 8

People Who Oppose the School Garden

Group	Response Percent	Response Count
No one	69.84	44
Owner/Administration	14.29	9
Support Staff	6.35	4
Unsure	6.35	4
Teachers	1.59	1
No Stance	1.59	1

The fifth and final question on subjective norm asked, "What is your view on the use of the school garden?" to ascertain the respondent's personal view. As shown in Table 9, no participant had a completely negative view of the garden. An overwhelming majority of 51 respondents (80.95%) were entirely positive. The positive responses included that it was great for hands-on experience, it gave students an outdoor time and lessened technology use, encouraged social emotional learning such as patience, created a positive environmental outlook, and allowed students to understand where their food comes from.

The remaining 12 respondents (19.05%) were positive but added negative aspects to their answers (see Table 9). The negative aspects of the school garden included lack or time, lack of funds for the garden, a short growing period, lack of buy-in, no training for teachers, and additional planning that needed to take place.

Table 9

Participant View of the School Garden

Personal View	Response Percent	Response Count
All Positive	80.95	51
Positive but Negatives Exist	19.05	12

3. Image

In the TAM2, Image refers to a potential boost in status a teacher may get from adopting and using the new technology (Venkatesh & Davis, 2000). Image directly influences the perceived usefulness of the new technology which then informs the intention to use. The survey included two questions that pertained to image in relation to school gardens.

The first question related to image was "How do people in your school describe or talk about teachers who use the school garden?" Of the 62 responses, 42 (67.74%) stated that teachers who used the school garden were viewed in a positive light, 11 (17.74%) were unsure, and 7 (11.29%) reported mixed views, so both positive and negative aspects. Two respondents (3.23%) did not give quantifiable answers (see Table 10).

Participants who responded positively said people in the school "think it's a great asset" and that those who use the garden "are referred to in many ways… tree huggers, nature lovers, environmentalists, creative teachers, outdoor educators, etc." Teachers who used the garden were "often recognized for the work being done" and "they see the active learning that the garden provides." The ones who reported mixed views stated that some teachers "wouldn't want to get bothered" while another states that it is viewed as "wasting instructional time to play in the dirt." A few participants said that the garden was viewed positively as long as it was well maintained which is an issue as one teacher stated that "nobody has time (to maintain it)". We are all too overloaded with requirements."

Table 10

View of Teachers Who Use the School Garden

View	Response Percent	Response Count
Positive	67.74	42
No Difference/ Unsure	17.74	11
Mixed	11.29	7
Other	3.23	2

The second question about image asked, “What influence does the garden have on how the community views the school?” There were 62 total responses with 39 (62.90%) being positive, 18 (29.03%) being unsure or reporting that the garden had no influence in the community, and 5 (8.06%) stating that the garden had both a positive and negative influence in the community (see Table 11).

The positive responses pointed to the involvement of community members, including parents, garden clubs, and civic organizations. The community also contributed funds to the garden at some schools through grants and donations from individuals and businesses. The other two positive aspects mentioned was the beautification of the school grounds and the ability to sell produce and flowers to community members. The mixed influence stated that lack of maintenance created a negative view from the community and another participant mentioned that the required security for volunteers had limited the number of those willing to help.

Table 11

School Garden Influence on the Community

Influence	Response Percent	Response Count
Positive	62.90	39
No Influence/ Unsure	29.03	18
Mixed (Both Positive and Negative Influence)	8.06	5

4. Job Relevance

Job relevance is defined in the TAM2 as the relevance of the technology to the job needing to be performed (Venkatesh & Bala, 2008). This directly affects the perceived usefulness of a new technology and the teacher’s intention to use the technology. This section of the survey contained one question.

The job relevance question was “How does the school garden relate to the classes and curriculum you teach?” Of the 62 participants who responded, 51 (82.26%) stated that the garden

had a positive relevance on their classes and curriculum, 5 (8.06%) gave both positive and negative aspects, while 3 (4.84%) saw no relevance between the garden and their classes. Three participants (4.84%) felt that the question was not applicable to the position that they held at their school (see Table 12).

Some teachers who felt positively about the school garden in relation to their classes gave many different standards that were covered through garden use, including the nitrogen cycle, collecting and graphing data, poetry, soil science, climate change, life cycle of plants, word problems, and drawing. One teacher used it to teach his/her students with special abilities vocational skills while an ESL teacher used vocabulary of things familiar to students whose parents often worked in agriculture. The teachers who had a mixed view felt it did not lend itself to use in their current curriculum or classes they were teaching or that it was an extracurricular activity at their school.

Table 12

School Garden Relation to Classes and Curriculum of Participant

Relation	Response Percent	Response Count
Positive Relevance	82.26	51
Mixed Relevance (Both Positive and Negative)	8.06	5
Not Relevant	4.84	3
Not Applicable	4.84	3

5. Output Quality

The TAM2 defines output quality as the quality of work that is performed while using the new technology (Venkatesh & Bala, 2008). The view of whether the technology increases output quality directly relates to the perceived usefulness of the technology and the teacher's intention to use it. This section of the survey had one question.

The question asked about output quality was "How does the school garden affect students' learning in your classes?" There were 65 responses and 57 (87.69%) stated that the garden has a positive effect on student learning. Seven participants (10.77%) stated the garden has no effect on their classes while there was one response (1.54%) that was not applicable to the question (see Table 13).

The teachers with positive responses shared many reasons they felt the garden was beneficial in relation to student learning. In academics, teachers stated that "kids grasp the concepts easier," "they are interested in lessons that relate to the garden," "it gives them sensory and hands on experiences," "the school gardens are tied into the Next Generation Science Standards," it is a "great motivator and opportunity for project-based learning," and "it gives real experience to connect technical learning to." The majority of positive comments were related to the students' outlook, wellbeing, and social emotional learning. Some of the statements from teachers included that "the hands-on learning also reduced, if not eliminated, behavior problems and off task issues," "they talk about how calm they feel," it has increased "the ability of students to work in teams," they show a "sense of pride and commitment to their community and environment," students are "more confident and focused," and "increases positive attitudes toward school." There were also mentions of students developing an appreciation for food and a positive growth in their nutrition.

Table 13

School Garden Effect on Student Learning

Effect	Response Percent	Response Count
Positive	87.69	57
No Effect	10.77	7
Other	1.54	1

6. Result Demonstrability

Result demonstrability is defined in the TAM2 as the ability to show the results of the adoption of the technology (Venkatesh & Bala, 2008). This also directly relates to the perceived usefulness of the technology and the teacher's intent to use it. There were two questions on the survey related to result demonstrability.

The first question asked, "What, if any, do you believe are the benefits of using the school garden?" The open response allowed for teachers to mention multiple benefits, so the total response count of 132 is larger than the total number of 63 responses. The academic benefit was the most mentioned at 39 responses, with nutrition and physical health (29), outdoor and environmental experience (25), and social/emotional wellbeing (24) all receiving larger responses. The positive aspect of community building within the school and outside of school also received 13 responses. Two responses did not align with the question asked (see Table 14).

The main academic benefit was the hands-on learning where students were able to apply concepts learned in the classroom to the real world. The students also experienced a more positive nutritional viewpoint due to understanding where their food came from, the work required to be successful, and were " more willing to try to eat vegetables and fruits grown in the garden." Many teachers mentioned the mental health benefits such as a "boost in morale," "positive growth emotionally," the garden provided "a sense of place," and the "sense of wonder and amazement to see items come to bloom…and connecting with mother earth." Students learned social skills like "collaboration and empathy," "kindness and compassion," "teamwork," "camaraderie," and teachers saw an overall increase in social skills.

Table 14

Benefits of School Garden Use

Benefit	Response Count
Academic/ Hands-On Learning	39
Nutrition/ Physical Health	29
Outdoor/ Environmental Experience	25
Social-Emotional/ Mental Health	24
Community Building (School and Outside)	13
Other	2

Note. Response count is higher than responses due to participants sharing multiple benefits.

The second question was "What, if any, do you believe are the barriers of using the school garden?" There were 62 total responses, however, many participants offered multiple barriers, thus the higher 107 response count in Table 15. The most mentioned barrier to using the school garden was time (24), with funds and negative views both garnering 18 mentions. Staffing (13), a short growing season or weather (11), lack of space or a poor location (9), and little to no training (6) rounded out the most mentioned. There was a small group of other barriers mentioned (6) such as vandalism and pests and 2 participants stated that there were no barriers to using the garden.

The time barrier was mentioned repeatedly with teachers lamenting the lack of time due to "busy teaching schedules," "too many expectations on teachers," "not enough time to make use of it on a regular basis," and not having "time to care for gardens." Many teachers felt they did not have access to needed resources such as water or materials for the garden, and that they lacked the funds to purchase these items or to maintain it. Some respondents felt the greatest

barrier was the lack of teacher buy-in and stated that "getting other people to realize that time spent in them is just as worthy as sitting in a desk looking at a test." Some teachers also faced opposition from the janitorial or maintenance staff who felt it would become a burden for them while others mentioned the lack of a designated person to run or maintain the garden.

Table 15

Barriers to School Garden Use

Barrier	Response Count
Time	24
Funds/ Resources	18
Negative Views/ Lack of Buy-in	18
Staffing (During School and Holiday/Summer Care)	13
Growing Season (Not During School Year)/ Weather	11
Location/ Lack of Land or Space	9
Other (Vandalism, Pests, etc.)	6
Training/ Professional Development	6
None	2

Note. Response count is higher than responses due to participants sharing multiple barriers.

7. Voluntariness

Voluntariness in the TAM2 is whether the use of the new technology is voluntary or mandatory. This variable directly affects the intention to use the new technology. The survey contained four questions about the voluntariness of the use of the school garden.

The first question asked, "Is the garden use voluntary or mandated in your school?" A majority (55 or 82.09%) of the 67 responses indicated that the use of the school garden was voluntary with a small percentage (5 or 7.46%) stating it was mandated and another 3 respondents (4.48%) explaining that the voluntariness of use was dependent on the classes being taught or position of the teacher. Four participants (5.97%) were unsure (see Table 16).

Table 16

Is Garden Use Voluntary or Mandated

Voluntariness	Response Percent	Response Count
Voluntary	82.09	55
Mandated	7.46	5
Unsure	5.97	4
Mixed Depending on Position/ Class	4.48	3

The second question on voluntariness was "Who decides if teachers are required to use the school garden?" There were 65 responses with some mentioning more than one person or group who was responsible for the decision of school garden use. Twenty-two participants (33.85%) indicated that there is no requirement, 20 (30.77%) said teachers were responsible for the decision, 14 (21.54%) stated principals or other administrators were responsible, 2 (3.08%) were unsure who would be the decision maker, and 1 (1.54%) stated that school garden use was just expected. Six respondents gave an answer that did not align with the question (see Table 17).

Table 17

Who Decides on School Garden Use Requirement

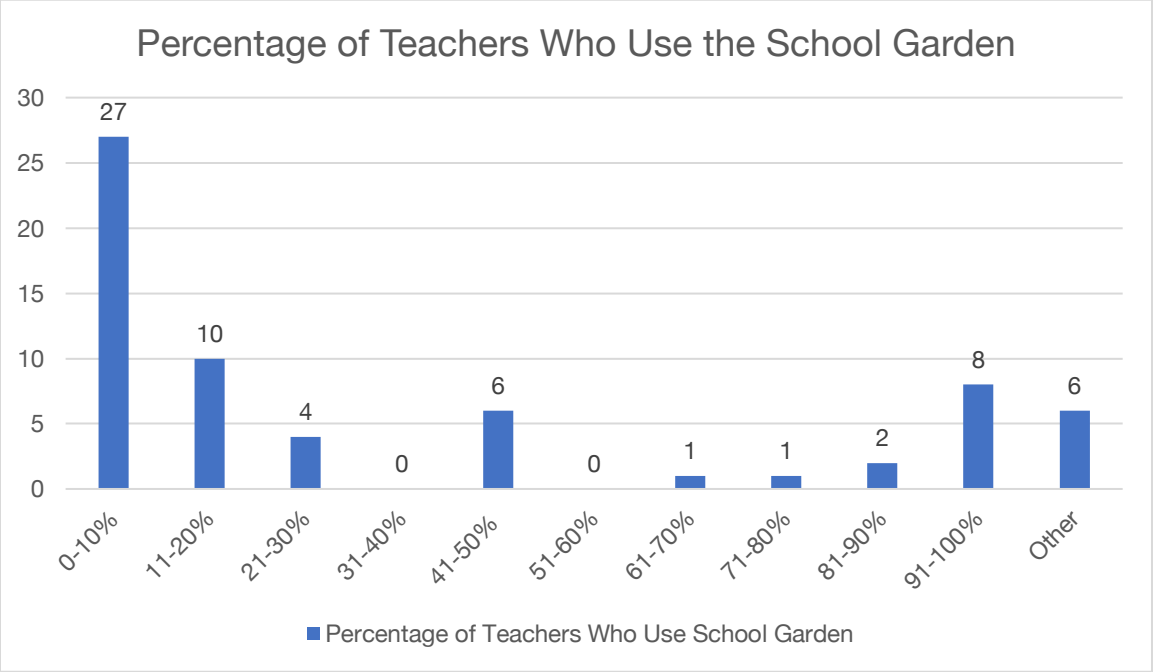
Group	Response Percent	Response Count
Expected	1.54	1
No Requirement	33.85	22
Other	9.23	6
Principal/ Administration	21.54	14
Teachers	30.77	20
Unsure	3.08	2

The third question asked, "Approximately what percentage of teachers do you believe utilize the garden at your school?" As Figure 11 shows, 27 respondents (41.54%) reported that 10% or less of their teachers utilize the school garden. The remainder of the responses varied widely with only 8 (12.31%) indicating that 91-100% of teachers use their school garden.

Reasons given for lack of teacher use of the garden included that the garden was "an off-campus volunteering opportunity," "some teachers feel they have to be tied to their curriculum that they can't think outside the box," with one teacher stating that the garden "fell to the wayside" and was no longer in use. Multiple teachers pointed to the fact that certain subjects, such as science, used the garden while others stated that the garden was taught by one assigned teacher.

Figure 11

Percentage of Teachers Who Use the School Garden



The final question on voluntariness asked, "How is the garden used in other ways besides instruction?" Multiple uses were given on some of the responses thus the total number of responses (64) was lower than the response count (88). The largest response was using the garden as a food source (24) with its use as an outdoor space receiving a large response as well (21). Community building (9), extracurriculars (8), beautification of the school (7), life lessons and social/emotional learning and wellbeing (7), and a habitat for animals (2) were all

mentioned. Two participants indicated that there was no other use for the garden besides instruction while two others were unsure. Six gave responses that were not relevant to the question (see Table 18).

Teachers described the many uses of the garden including it being "used as an outdoor space with seating in large groups or in small groups," "a great place to read and write," "as a pollination station, bird watering and bird feeding station," and "a peaceful, meditative, beautiful place to gain balance." The most mentioned reason was as a food source. Some schools use the garden to grow food for students "so students were encouraged to eat what they grow." One teacher mentioned that "surplus harvests go to the local food bank, to the school cafeteria, and to low-income students on a weekly basis, for free."

Table 18

Garden Use Other Than Instruction

Use	Response Count
Food Source (School and Outside Community)	24
Outdoor Space (Play, Outdoor Classroom, School Functions, etc.)	21
Community Building	9
Extracurriculars (Clubs, Summer Camp, etc.)	8
Beautification	7
Life Lessons/ Social-Emotional Learning	7
Habitat	2
None	2
Unsure	2
Other	6

Note. Response count is higher than responses due to participants sharing multiple uses.

8. Perceived Usefulness

Perceived Usefulness is defined in the TAM2 as the believed usefulness of a new technology in relation to job achievement (Venkatesh & Davis, 2000). It directly affects the

intention to use the new technology and is thought to be even more important than the ease of use in adoption of new technology. The survey contained three questions about the perceived usefulness of the school garden.

The first question asked, “What is the usefulness of the school garden in instruction and student learning, if any?” Survey participants noted the use of the garden in covering academic standards (31), making real-world connections and developing practical skills (26), and creating an appreciation of the outdoors (13). Also mentioned was a greater focus and engagement among students (7), hands-on learning (6), inclusiveness (6), positive interactions between those utilizing the garden (6), and social emotional learning in students (5) (see Table 19).

Academic usefulness included “hands-on learning,” “cross-curricular learning,” and helped teachers “deliver the curriculum in a meaningful way.” Many mentioned specific lessons they covered in the garden such as watching seeds sprout, life cycle of plants, and connecting reading to real world items. One teacher mentioned “it builds responsibility, pride, accomplishment, cooperative learning, and an appreciation of nature.”

Table 19

Usefulness of the School Garden in Instruction and Student Learning

Usefulness	Response Count
Academic Standards	31
Real-World Connections/ Practical Skills	26
Exposure to and Appreciation of Outdoors	13
Greater Focus and Engagement	7
Hands-On Learning	6
Inclusiveness (ELA, Students with Disabilities, Cultural Connections, etc.)	6
Positive Interactions (Between Students, Students and Adults)	6
Social-Emotional Learning	5
Other	7

The second question was "What is the usefulness of the school garden beyond instruction and student learning, if any?" The participants mentioned several ways the garden was useful beyond instruction, including encouraging community involvement and building relationships (24), growing food that is used for eating at school or sharing with the food insecure (21), social emotional learning and mental health (17), and practical skills and life lessons (14). Also mentioned was creating a positive environmental outlook (10), nutritional and health benefits (9), beautification of school grounds (8), inclusiveness of all students (6), and allowing teachers to use the space as an alternative learning space (3) (see Table 20).

Community involvement looks different at each school. One teacher stated that "community involvement…gave our school (a) good view in the community. We are an alternative school." At one school "students regularly donate over 6,000 lbs. of produce to the local food bank every year." One teacher stated, "it builds relationships, which have been proven time and again, relationships are the real reasons students learn with a teacher" while another teacher mentioned that "the nearby nursing home residents often use the space for walks and chats."

Table 20

Usefulness of the School Garden Beyond Instruction and Student Learning

Usefulness	Response Count
Community Involvement/ Builds Relationships	24
Food (to Eat, Sell, Food Bank Donations, etc.)	21
Social-Emotional Learning/ Mental Health	17
Practical Skills/ Life Lessons	14
Positive Environmental Outlook	10
Nutrition/ Health Benefits	9
Beautification	8
Inclusiveness	6
Alternative Learning Spaces	3
Other	3

The final question about perceived usefulness asked, “Does the garden increase your effectiveness as a teacher and if so, how?” Of the participants who responded (61), 47 (77.05%) answered that the garden does increase his/her effectiveness, 7 (11.48%) stated that it did not, and 5 (8.20%) responded that the question was not applicable due to their current position or status (mostly due to retirement). Two answers (3.28%) did not accurately answer the question (see Table 21).

Teachers mentioned that the garden was great for student behavior because they wanted to be outside. Others stated, “it lets me be creative,” “I have more energy being outside and am more enthusiastic,” “it offers an opportunity to diversify the learning space and make memories,” “makes you more well-rounded and the kids see you in more of a natural state,” and “it offers something concrete.” One teacher explained that “learning is natural, and we keep trying to put learning in an unnatural setting. Having a piece of nature, where people were truly meant to learn, increases the effectiveness of all interactions. It provides experiences that help people flourish.”

Table 21

Does the School Garden Increase Your Effectiveness as a Teacher?

Answer	Response Percent	Response Count
Yes	77.05	47
No	11.48	7
Not Applicable	8.20	5
Other	3.28	2

9. Perceived Ease of Use

Perceived ease of use is the believed ease of use of the new technology (Venkatesh & Davis, 2000). It affects both the perceived usefulness of the new technology as well as the

intention to use it. The survey asked four questions related to the participants' views of the ease of use of the school garden.

The first question asked, "How easy is it to use the garden in student instruction?" As shown in Table 22, 23 respondents (35.38%) stated the garden was very easy to use in instruction while 19 (29.23%) answered that it was easy. Twelve participants (18.46%) answered with mixed responses, explaining that it was easy if certain parameters were met. Seven respondents (10.77%) found it difficult to use the garden in instruction with four respondents (6.15%) stating the question was not applicable or did not directly answer the question.

While many teachers found using the garden to be very easy or easy (64.61%), 12 teachers qualified their positive response with a negative or necessary things that must be in place for the garden to be easy to use. Their responses included "short instruction times and transitions," "garden location," and ease of use dependent "on the school's commitment to making the garden accessible to all classes and having knowledgeable people who can support the teachers in their instruction." The teachers who found using the garden difficult pointed to "the planning and getting hesitant students to participate," "hard to make the time," location of the garden and the distance from the classroom, while one teacher stated it was "not as easy as putting on a video."

Table 22

How Easy is it to Use the School Garden?

Ease	Response Percent	Response Count
Very Easy	35.38	23
Easy	29.23	19
Depends/ Mixed Response	18.46	12
Difficult	10.77	7
Other/ Not Applicable	6.15	4

The second perceived ease of use question was, “How difficult is it to use the garden in student instruction?” Half of the respondents (32) stated that the garden was not difficult to use in instruction, 24 (37.5%) qualified their answer with details that needed to take place to make the garden less difficult to use, and 6 respondents (9.38%) mentioned that the garden was difficult to use in instruction. Two respondents (3.13%) did not find the question applicable to their position (see Table 23).

The difficulties mentioned included needing to raise funds, lack of clear communication between staff members, lack of time, and student management being more difficult outside. Weather issues such as long winters, administrators “resistant to the idea of taking students outside of a traditional classroom,” and “the testing culture of the school” were all seen as difficulties.

Table 23

How Difficult is it to Use the School Garden?

Difficulty	Response Percent	Response Count
Not Difficult	50	32
Depends/ Mixed Response	37.5	24
Difficult	9.38	6
Other/ Not Applicable	3.13	2

The next question asked, “What training did you receive on how to best use the school garden with students?” Several respondents had more than one response, so the response count (84) is greater than the number of participants who answered the survey question (66). A majority of the participants received no formal training and were self-taught (38), 18 participated in professional development or some form of garden program outside of school (such as Master Gardeners) where they received training, 14 had mentors who trained them, while 13 relied on

their past experience such as growing up on a farm or having a home garden. One respondent did not feel the question applied to their situation (see Table 24).

Table 24

Personal Training Received on How to Best Use the School Garden with Students

Type of Training	Response Count
None/ Self-Taught	38
Professional Development/ Garden Program	18
Mentors	14
Past Experience	13
Not Applicable	1

As a follow up to the last question, the final question asked, "Approximately how much time was spent in training teachers on how to best use the garden at your school?" Of the 63 responses, 39 participants (61.90%) stated that the teachers at their school had received no training on using the school garden, 12 (19.05%) had received less than 10 hours, and 4 respondents (6.35%) had received more than 10 hours of training. Eight participants (12.70%) did not answer the question as presented (see Table 25).

Table 25

Time Spent Training Teachers on How to Use the School Garden

Amount of Time	Response Percent	Response Count
None	61.90	39
<10 Hours	19.05	12
>10 Hours	6.35	4
Other	12.70	8

Research Question Two

The second research question asked, "How do the attitudes and beliefs of teachers with successful gardens differ from those with unsuccessful gardens?" To ascertain the success and attitude of teachers with gardens, each individual respondent's answer was considered

independently of other participants. The success of the garden and the teacher attitude was quantified and then compared.

To determine the success of the garden, three questions from the survey were used to imply the success:

1. If your school currently has a garden or has had a garden in the past five years, how long has/had it been operating and in use?
2. How does your school administrator(s) view the use of the school garden?
3. Approximately what percentage of teachers do you believe utilize the garden at your school?

These three questions inform the time the garden has been in use, the support of administration, and the amount of teacher usage. Each answer to these questions was given a number between 1 and 3 quantifying the answers. The answers were then averaged to give an overall success score.

The first question was assigned a ranking of 1, 2, or 3 based on the amount of time the garden had been in existence. If it had been there for 1 year or less or was no longer in use, it was assigned a 1. A garden older than 1 year but less than 5 received a 2 and anything in use longer than 5 years was assigned a 3. The second question was also assigned a ranking of 1, 2, or 3 based on the support of the school administration. A positive administrator was assigned a 3, mixed support received a 2, and negative administration was assigned a 1. The third question was done in the same way with 75% or more teachers using the garden received a 3, 25-75% of teacher use received a 2, and less than 25% use received a 1.

To determine teacher attitude toward the garden, the answers from the following three survey questions were viewed:

1. What is your view on the use of the school garden?

2. Does the garden increase your effectiveness as a teacher and if so, how?
3. How easy is it to use the garden in student instruction?

These three questions inform the teacher view of the garden, if the teacher thinks the garden makes them more effective, and how the teacher views the ease of use of the garden in instruction. As with determining garden success, each of the responses to these three questions were quantified with a number between 1 and 3 denoting the teacher attitude toward the garden.

The first question was assigned a rank of 1, 2, or 3 based on the teacher's view of the garden. If the teacher had an entirely positive view of the garden, the answer received a 3. If the teacher qualified the positive answer with something that denoted difficulty, it received a 2, while negative responses received a 1. The second question was treated the in the same manner with teachers who thought the garden increased their effectiveness receiving a 3, those who qualified their response with a necessary requirement for them to be more effective receiving a 2, and those who responded negatively receiving a 1. The answers to the third question received a 3 if they found the garden very easy to use, a 2 if they felt it was easy and/or qualified the response, and a 1 if the use of the garden proved difficult.

Once values were assigned for the attitudes of the teachers and the success of the school garden, a Pearson correlation coefficient test was run to determine if there was a correspondence between the two variables. The Pearson correlation between the success of the school garden and attitude of the teacher ($r = .490$) indicated a moderate positive correlation with the correlation being significant ($p = .002$).

Table 26

Correlations of Success and Attitude

Correlations

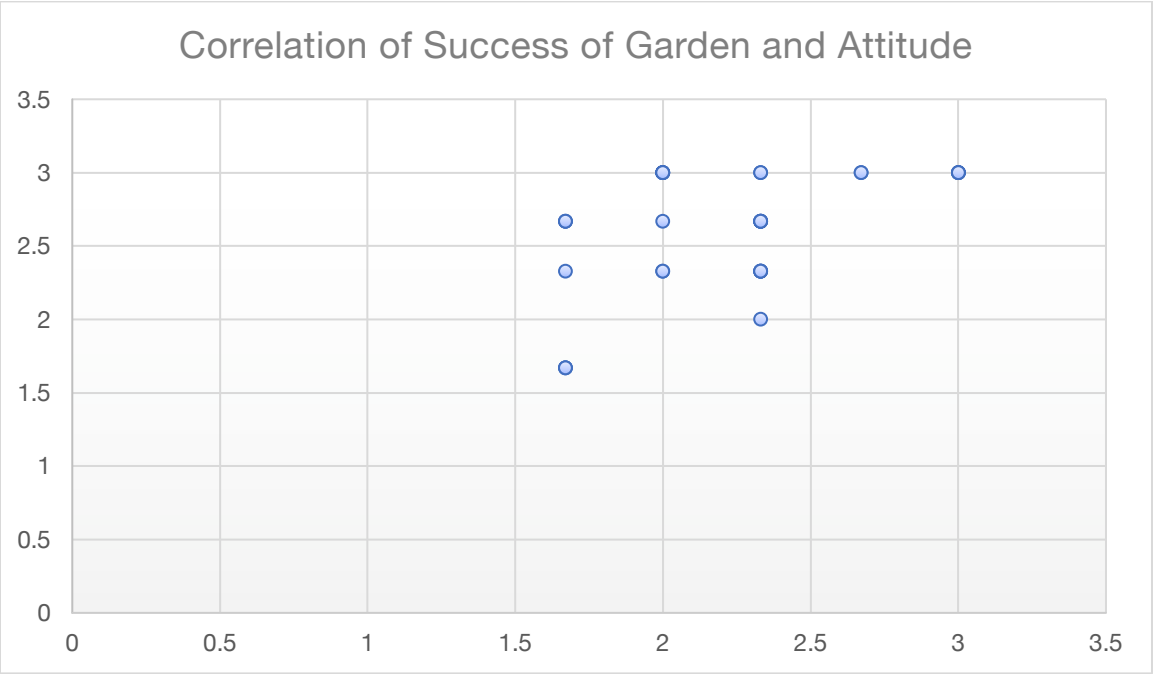
		Success	Attitude
Success	Pearson Correlation	1	.490**
	Sig. (2-tailed)		.002
	N	37	37
Attitude	Pearson Correlation	.490**	1
	Sig. (2-tailed)	.002	
	N	37	37

**. Correlation is significant at the 0.01 level (2-tailed).

The data was then graphed on a scatterplot to have a visual representation of the correlation. See the scatterplot below (Figure 12) denoting the positive linear correlation between the two variables.

Figure 12

Correlation of Success of Garden and Attitude



This indicates that there is a positive relationship between the success of the school garden and the attitude of the participant.

Research Question Three

The third research question asked, "Does a teacher's perceived usefulness of the school garden seem to relate to their frequency of use?" To determine the teacher's perceived usefulness of the school garden and the frequency in which he/she used the garden, each individual respondent's answers were considered independently of other participants' answers. The perceived usefulness of the garden and the frequency in which he/she used the garden was quantified and then compared.

To ascertain the teacher's perceived usefulness of the school garden, three survey questions were used to imply perceived usefulness:

1. What is the usefulness of the school garden in instruction and student learning, if any?
2. What is the usefulness of the school garden beyond instruction and student learning, if any?
3. Does the garden increase your effectiveness as a teacher and if so, how?

These three questions inform the perceived usefulness of the garden in instruction, the perceived usefulness of the garden outside of instruction, and the perceived usefulness of the garden in teacher effectiveness. Each answer to these questions was given a number between 1 and 3 quantifying the answers. The answers were then averaged to give an overall perceived usefulness score.

The first question was assigned a ranking of 1, 2, or 3 based on whether the teacher found the garden to be useful in instruction. If the teacher found it useful, it was assigned a 3. If they

found it useful but qualified its usefulness, it was assigned a 2. If they did not find the garden to be useful in student instruction, it was assigned a 1. The second question was also assigned a number between 1 and 3 based on the teacher's perceived usefulness of the garden outside of student instruction. If the teacher found it useful outside of instruction it was assigned a 3, if they qualified their response, it was assigned a 2, and if they did not find it useful outside of instruction it was assigned a 1. The third question was treated in the same manner. If the teacher answered that yes, the school garden increased their effectiveness as a teacher, it was assigned a 3. If they answered yes, it increased their effectiveness, but qualified the response, it was given a 2. An answer of no, the garden did not increase their effectiveness as a teacher, it was assigned a 1. The values assigned to these three answers were then averaged to give a single numerical value to the perceived usefulness of the school garden.

The amount of time a participant used the school garden was taken directly from question 4 on the survey: "If your school currently has a garden or had one in the past five years, approximately how often do/did you use it with students?" The answer to the question was quantified on a scale of 1 to 3. If the teacher used the garden daily or weekly, it was assigned a 3. If they used it monthly, the answer was assigned a 2. If they used it less than monthly, the answer was assigned a 1.

Once the values were assigned to the perceived usefulness of the school garden and the frequency of use, a Pearson correlation coefficient test was run to determine if there was any relationship between the two variables. The Pearson correlation between the perceived usefulness of the school garden and the frequency of use ($r = -.007$) indicated no correlation with no significance ($p = .968$).

Table 27

Correlations of Frequency and Perceived Usefulness

Correlations

		Frequency	Perceived Usefulness
Frequency	Pearson Correlation	1	-.007
	Sig. (2-tailed)		.968
	N	38	38
Perceived Usefulness	Pearson Correlation	-.007	1
	Sig. (2-tailed)	.968	
	N	38	38

This indicates there is little to no relationship between the perceived usefulness of the garden and the frequency of use.

The answers the survey participants gave indicated that there were several reasons there is no correlation between these two variables. While a majority of the participants indicated that they had a strong perception of usefulness of the school garden (30 out of 38 participants, or 78.95% scored a 3 out of 3), many stated that they did not use it often due to weather or a short growing season, that it is only used for certain courses which they did not teach (mostly science), or that a specific person was assigned to use the garden for instruction (such as a science lab teacher or farmer).

The following chapter will discuss the responses of the participants and the major findings using the research questions as the structure. The analysis of the data in relation to the Extended Technology Acceptance Model will give insight into the attitudes of teachers in relation to school gardens and their success. Recommendation for practice and future research will also be offered.

Chapter 5: Discussion

This elicitation study was based on the theoretical framework of the Extended Technology Acceptance Model (TAM2), which was designed to better understand the adoption and use of new technology. The TAM2 informed the 31 open-ended question survey about the adoption and use of school gardens. Ninety-nine teachers in the United States who have or have had access to a school garden within the last five years responded with insights into their beliefs and experiences. This elicitation study was the first to use the TAM2 as the theoretical model to study the use of school gardens.

Problem

School gardens are expensive and time-consuming undertakings, and it is important to better understand the benefits of the gardens and the barriers that prevent them from being successful. The benefits of school gardens, which include academic achievement, social/emotional growth and wellbeing, increased health, positive environmental outlook, and community involvement, have been well documented in research (Bowker & Tearle, 2007; Fleener et al., 2011; Landry & Logue, 2017; Lucas et al., 2018; Ober Allen et al., 2008). The barriers have been the focus of less research, but lack of time, lack of funding, insufficient staffing, and lack of training or curriculum have all been mentioned as hindering the use and success of the garden (Burt et al., 2018; Landry & Logue, 2017). Over time, these barriers can stifle the use of the garden for student instruction by teachers and can result in an unsuccessful or dead program.

Purpose

The purpose of this elicitation study was to ascertain a teacher's attitudes and beliefs associated with the school garden and how this influences the garden's success. Elicitation

studies are important in understanding the participants' beliefs in that particular situation and environment. They allow the group being studied to use their own words to communicate their thoughts and ideas and use that information as the basis for larger quantitative studies. This elicitation study sought to understand the beliefs and views of the teachers who have or have had access to a school garden within the last five years and how that relates to their use of the garden in student instruction.

Research Questions

1. What do teachers report relates to their use of the school garden?
2. How do the attitudes and beliefs of teachers with successful gardens differ from those with unsuccessful gardens?
3. Does a teacher's perceived usefulness of the school garden seem to relate to their frequency of use?

Methodology

This study was a qualitative elicitation study based on the Extended Technology Acceptance Model (TAM2). The TAM2 was originally designed to understand the adoption of new technology and how different variables affect the intention to use and use of the technology. The school garden was the new technology being viewed through the TAM2 in this study. A thirty-one question open-ended survey was designed by the researcher using the TAM2 as guide. Each variable in the TAM2 directly or indirectly related to the adoption and use of the garden informed one or more question. The participants were recruited through social media, to include Facebook, Twitter, and Instagram, among others. The survey was created using Qualtrics and the link to the survey was included in the social media posts and ads. The first question of the survey determined if the participant met the criteria needed to participate, the next four questions were

used to collect demographics of the participants, and the remaining questions aligned with the TAM2. The questions were randomized to increase data collection due to the length of the survey. The researcher analyzed the data collectively by question for research question 1 and then categorized the answers by themes. For research questions 2 and 3, the researcher analyzed the data independently by participant and then assigned a number in order to determine correlation between two variables. The information discovered in this study will be used to inform broader quantitative studies.

Major Findings

This elicitation study collected data from 99 participants who teach or have taught at a school with a garden within the last five years. The respondents represent schools in 26 different states with 28% from the Southeast, 25% from the Pacific region, 22% from the Midwest, 11% from the Southwest, 11% from the Northeast, and 3% from the Rocky Mountains. The teachers hold a variety of roles within the schools where they work with the largest percentage (35.62%) teaching in an elementary school with middle school (16.44%) and high school (9.59%) representing the next highest numbers. Most of the elementary teachers teach all academic areas and the middle and high school teachers were mostly science teachers. A majority of the respondents (26) have been in their current role at school for less than five years. Total years of experience in education range from less than five years (3.13%) to more than 31 years (18.75%) with the largest number of respondents (34.38%) have worked at schools for 11-20 years.

The Extended Technology Acceptance Model (TAM2) was used as the theoretical model on which the survey was designed and the data was analyzed. The TAM2 has been used in many areas to better understand the adoption and use of new technology, including in the work environment (Venkatesh & Davis, 2000), in website design (Wu et al., 2011), and in recreational

technology use (van der Heijden, 2004). Venkatesh and Davis (2000) posited that each of the seven variables (experience, subjective norm, image, job relevance, output quality, result demonstrability, and voluntariness) affect the perceived usefulness and the intention to use the new technology. Davis found perceived usefulness and perceived ease of use to both be subjective but found that they were more important to understand in relation to adoption and usage of technology than objective assessments. He also determined that perceived ease of use is an antecedent to perceived usefulness and that it directly affects perceived usefulness and the intention to use and suggested that the chain of causality was ease of use > usefulness > usage (Davis, 1989).

The following reviews the findings in the survey data and how the data aligns with previous research and literature on school gardens. The perceived ease of use, perceived usefulness, and usage from the TAM2 are used to structure and guide the findings. Unanticipated results and a summary will follow. Recommendations for practice and research are offered before ending with the conclusion of the study.

Perceived Ease of Use

Perceived ease of use is defined as the believed ease of use of a new technology (Venkatesh & Davis, 2000). The TAM2 suggests that if a teacher believes the school garden is easy to use and incorporates it into current curriculum and the school day, then that will translate into intention to use. Table 22 reports the belief of the participants on the ease of use of the school garden in student instruction. Most of the teachers found the garden very easy (35.38%) or easy (29.23%) to use. The respondents mentioned the ease of using the garden in science instruction as well as math and writing. This reflects what earlier research indicated. Science is the primary subject taught in the garden (Landry & Logue, 2017; Jaeschke et al., 2012), with

math and language arts rounding out the top three subjects (Williams & Dixon, 2013). The hands-on learning was also an important aspect that was mentioned in the collected data. The hands-on learning of the garden allows for many different skills, not just academics, to be learned, including inter- and intrapersonal skills, stewardship, and healthy life choices (Miller, 2007)

Table 22 reports that 18.46% of respondents found the garden easy to use if certain parameters were met, and 10.77% found it difficult to use in student instruction. The barriers mentioned included the need for additional planning, inclement weather or a shorter growing season, lack of time, need for support staff, and location of the garden. Research indicates that the lack of time for teachers is the most prevalent barrier in schools with the lack of staffing directly following (Burt et al., 2018). The lack of time not only encompasses the lack of time for planning (Dirks & Orvis, 2005), but also the time it takes out of traditional classroom instructional time (Graham & Zidenber-Cherr, 2005). The need for support staff is twofold. They remove the burden on teachers to care for and maintain the garden (Thorp & Townsend, 2001) and can also serve as garden coordinators (USDA, 2017). Since lack of funding is another barrier to school garden use mentioned in research, it is important for schools to utilize volunteers and other knowledgeable gardeners, such as Master Gardeners and Extension Services, who can help mitigate the upkeep and use of the garden (Lucas et al., 2018).

Table 23 reports the findings of the question “How difficult is it to use the school garden?” Exactly half (50%) of respondents stated that the garden was not difficult to use. Specifically mentioned regarding ease of use of the garden were the subjects of science and math, the close location, and the enthusiasm of students to use the garden. The research on the use of the garden in academic instruction for math and science has been mentioned (Landry &

Logue, 2017; Jaeschke et al., 2012) however, the location of the garden seems to be a thread that runs between the belief the garden is easy to use and that it is not difficult. The ease of access to the garden is clearly an important variable and may influence the amount of instruction time spent in the garden. Research states that students who spend time in the school garden experience comfort and a reduction in stress (Thorp & Townsend, 2001) and have a more positive attitude toward school (Waliczek et al., 2000). The benefits of the garden then lead to less difficulty in use.

The participants who indicated they had mixed feelings about the difficulty of garden use (37.5%) as indicated in Table 23, point to lack of time, lack of funds, staffing needs, and student challenges such as behavior, distractions, and safety. Lack of time and staffing have been previously mentioned. Lack of funds is a barrier many school gardens face. The money needed for upkeep or supplies for lessons can be difficult to acquire and often leads to teachers using their own money to purchase what is needed (Burt et al., 2018; Skelly & Bradley, 2000). Schools need to plan for funding when starting a school garden. The sustainability of the school garden can be increased through nonprofit school food service and understanding how those funds can be managed and used for purchasing garden supplies (USDA, 2009).

Table 24 reports participants' responses on training received for the school garden. A majority (38) of the participants mentioned that they received no training or that they were self-taught. The lack of training for teachers is mentioned in early research (Skelly & Bradley, 2000) as a reason for lack of garden use by teachers. Teachers must receive training in any new curriculum or instructional strategy if they are to successfully use it. The lack of formal training results in teachers not being comfortable with the school garden and how to use it, thereby negatively impacting the amount of student instruction that takes place in the garden (Landry &

Logue, 2017). Teachers who receive training are more likely to use the garden leading to student benefits and a more successful garden (Skelly & Bradley, 2000). The remaining responses about teacher training mentioned receiving professional development (18), having a mentor to teach them (14), or drawing on past experience (13).

Perceived Usefulness

Perceived usefulness is "the extent to which a person believes that using the system will enhance his or her job performance" (Davis, 1989, p.320). In the TAM2, perceived usefulness is also influenced by experience, subjective norm, image, job relevance, output quality, result demonstrability, and perceived ease of use. The experience survey participants had with gardens outside of school was substantial, with 80.60% having experience with a home garden or farm (Table 4) and 41.38% of those who responded either helped to create or oversaw their school gardens (Table 3). This points to the importance of gardening with the respondents.

Administrators had a very positive view of the school garden (68.85%) as did the school districts (57.14%). Table 8 shows the responses to the question of who opposed the school garden with 69.84% mentioning that no one opposes it. Table 9 shows that their personal view was also positive, with 80.95% being positive and 19.05% stating that their view was positive but that there were some negatives. Negatives mentioned in the subjective norm questions included lack of time, lack of funds, lack of teacher training, and maintenance needs. These are all potential barriers that are mentioned in research that influence the success of the school garden. Research has shown that lack of time for maintenance and upkeep is a top barrier for administrators and the lack of funds may even prevent some schools from initially adopting a garden (Landry & Logue, 2017). Long term planning for the needed funds and maintenance needs and utilizing community partnerships will help in alleviating the burden these may cause.

Table 19 shows the responses when the survey asked what the usefulness was of the school garden in instruction and student learning. There were several different responses but the most mentioned were academic standards (31), real-world connections and practical skills (26), and an exposure to and appreciation of the outdoors (13). Research shows that the school garden is most often used for academic instruction (Landry & Logue, 2017) with hands-on learning allowing students the opportunity for understanding a real-world connection to the academic content (O'Brian, 2019). The work outdoors and in the garden gives students a greater appreciation for nature, the environment, and their place in the world (Alexander et al., 1995).

Table 20 reports the areas outside of student instruction in which the garden is useful. Community involvement was mentioned 24 times and research shows that a school garden can bring the school community together, including parents, teachers, and students (Lucas et al., 2018). It also is a great area for local community members not normally tied to the school to become involved. Local corporations are often willing to partner with schools to provide help and needed funding (Lopez et al., 2008) and Master Gardener programs and Extension Services can help with training and working alongside the school community (Alexander et al., 1995). This increased community involvement increases the positive outlook of the school garden and allows for barriers such as lack of time and funding to be overcome.

The second most mentioned reason for the school garden outside of instruction is the growth of food (Table 20). By using the food in schools, research has shown that students are more willing to eat what is grown and they increase their fruit and vegetable intake (Ober Allen et al., 2008). Respondents also mentioned donating the food to those with food insecurities in their communities. Sharing the food with those in need allows students to help those in their community and learn valuable life lessons about giving and compassion (Reis, 2015).

The survey participants overwhelmingly commented that the school garden increases their effectiveness as a classroom teacher (77.05%). The garden allows for the students to have hands-on experiences and for teachers to show concrete examples, tying content to active learning. Research shows that this increases overall critical thinking skills (Mabie & Baker, 1996) and that students retain the knowledge at a greater level when able to have hands-on experience (Smith & Motsenbocker, 2005). One of the barriers mentioned several times in the survey was the focus of schools on standardized testing and the lack of time available to get out into the garden. The research shows that this outside time in the garden would, in fact, increase student learning and possibly student test scores (Klemmer et al., 2005).

Usage

Figure 7 shows how often the survey participants use the school garden with 43.94% using it weekly. The survey data shows that the number of teachers who use the school garden varies between schools (Figure 11). The largest response (41.54%) stated that 0-10% of their teachers use the school garden. Multiple responses stated that only certain teachers in their school, most often science classes, used the garden for instruction or that a garden coordinator oversaw using the garden with students. The use of the garden in science has been well documented (Landry & Logue, 2017); however, lack of teacher training, as mentioned above, also plays a part in teachers not using the garden. Teachers who do not receive training do not use it because they do not understand how to incorporate it into learning (Landry & Logue, 2017). Teachers who receive training are able to use the garden effectively and allow students to reap the academic and social benefits they would not necessarily receive in a traditional classroom (Skelly & Bradley, 2000). Training would also create excitement and a buy in for teachers to try the garden as a new learning tool.

Table 16 shows that the use of the garden is most often voluntary in schools (82.09%) with only 7.46% of respondents stating the use is mandatory. This may also affect the usage of the garden. If teachers perceive that lack of time is a barrier and do not receive adequate training to learn how to properly incorporate the garden in student learning, this will lead to a lack of garden use and prevent students from receiving the benefits that school gardens can provide.

The data shows that there is no correlation between the frequency of use of the school garden and its perceived usefulness. A majority of respondents felt the school garden was useful in instruction; however, many stated outside reasons for their lack of use, including inclement weather, a short growing season, not teaching certain class subjects using the garden, or a specified person being the assigned teacher at the garden. Inclement weather and a short growing season can be ameliorated through better designed gardens and incorporating structures that allow crops to grow year-round. Local Extension Services would be able to help with the design although funding and lack of space could be a barrier (Burt et al., 2018). Teacher training is a must in increasing use of the garden. Extension Services could also train teachers and often at little to no cost (Thorp & Townsend, 2001). Teacher training is necessary to create buy-in and to encourage teachers to use the garden for student instruction (Jaeschke et al., 2012).

Unanticipated Results

The number of respondents to the survey (114 total) in relation to the number of people who encountered the survey was surprising. Facebook alone averages 1.73 billion daily active users (DAU) per day (Facebook Investor Relations, 2020). An advertisement was used to narrow the users to teachers so as to better reach the target audience. The number of people reached through the Facebook advertisement (45,845) seemed large when compared to the total number of survey responses (114). Research shows that Facebook offers a greater representative sample

that would otherwise be more difficult to reach and is quicker and more cost effective (Thorton et al., 2016). The location of the teachers reached was a greater range than would have been reached independently of social media, however, it was not a fast process. The limited target audience (teachers who have or have had access to a school garden in the last five years) and the length of the survey may have weakened the response rate.

The overwhelmingly positive viewpoint of the surveyed teachers toward the school garden combined with their lack of use was an unexpected discovery. Teachers seemed to understand the benefits of the garden but still did not use it for student instruction as regularly as would have been expected. There were very few truly negative responses indicating that the teachers are open to using the garden but that there is a barrier there that hinders the use.

Summary

The Extended Technology Acceptance Model (Venkatesh & Davis, 2000) can provide insight to the adoption and use of new technology, with great emphasis placed on the perceived usefulness and perceived ease of use informing the intention to use the technology. With the inclusion of the school garden into the TAM2 as the new technology, schools can better understand what influences the success of the school garden and use that information to help strengthen the garden program. School gardens offer many benefits to students including academic achievement, social/emotional learning, positive nutritional gains, and community interaction. This study shows that though these benefits are widely seen throughout schools, barriers remain that limit the frequency of use of the garden.

The collected data suggests that schools are willing to invest in the adoption and creation of the school garden but are lacking when it comes to training their teachers in use and best practices. Research shows that teachers must be trained in instructional use of the garden for

them to actually use it for student instruction (Blair, 2009; Graham & Zidenber-Cherr, 2005; Landry & Logue, 2017; Skelly & Bradley, 2000). Though a majority of teachers who participated in the survey stated the garden was easy to use, the lack of teacher use in their schools points to the fact that this is not true for every teacher. This suggests the need for initial professional development upon the creation of the school garden as well as continued support to further increase use for new and veteran teachers. Training has been shown to increase administrator interest in the garden, increasing support, and buy-in and excitement from teachers (Burt et al., 2018). The necessary training can be accomplished with little to no cost to the school by utilizing volunteers such as community garden experts and local Extension Services that offer free training and help to organizations (Burt et al., 2018; Thorp & Townsend, 2001).

The lack of mandatory use of the garden also seems to indicate that teachers who perceive barriers to the use of the school garden (time, funds, training, etc.) choose not to use the garden and focus instead on traditional classroom instruction. In the TAM2, the voluntariness of the new technology is directly related to the intention to use. Thus, the lack of mandatory use will negatively impact the intention to use. The TAM2 shows that "the direct effect of subjective norm on intentions for mandatory usage contexts will be strong prior to implementation and during early usage but will weaken over time as increasing direct experience with a system provides a growing basis for intentions toward ongoing use" (Venkatesh & Davis, 2000). This indicates that through use, the intention to use will grow and the gained benefits will fuel increased use. Thus, initial mandatory usage may increase the sustainability and success of the garden by creating teacher buy-in from positive usage experience.

Training, with a curriculum or tied to existing standards, combined with initial mandatory usage would strengthen the chance of a successful garden program that is self-sustaining.

Teachers need support to understand how to use the garden and then receive ongoing help in maintenance and planning. The survey data points to these areas as the missing components to existing garden programs.

Recommendations for Practice

This study sought to understand how the attitudes and beliefs of teachers about school gardens relates to the success and sustainability of a school garden program. The relevant literature and collected data of this study are considered in the following recommendations for practice:

1. For any school program to be successful, teachers need adequate training in the program and continued support (Skelly & Bradley, 2000). This creates buy-in and excitement from the teachers in the initial stages and gives them the foundation needed for beginning use and understanding (Thorp & Townsend, 2001). Additional support instructing teachers on how to incorporate the garden into their current curriculum would assist them in using it in academic instruction (Graham & Zidenber-Cherr, 2005). Once teachers see the benefits of the program, this will create a sustainable model and increase the likelihood of continued teacher use (Venkatesh & Davis, 2000).
2. Measurable academic goals need to be used with the school garden to show student growth through garden use. Schools today are very data-driven and, as some survey participants mention, test-focused. Research has shown that the use of school gardens in academic instruction have higher science achievement scores (Klemmer et al., 2005; Pigg et al., 2006) and improve their overall academic achievement (Lopez et al., 2008). Tying positive academic data to the use of the garden in student instruction may encourage future use and support.

3. The needs of the whole child need to be considered when planning curriculum. The garden is an excellent experiential learning tool but also encourages social/emotional growth and health and wellbeing. The needs of students and teachers to decompress, especially at this pandemic-focused time in history, should be considered. The garden increases positive attitudes toward school and is a great place to reduce stress while continuing their academic learning (Waliczek et al., 2001).
4. Food service employees in the school should become involved with the garden. They should be involved with student planning and help to incorporate fruits and vegetables into the daily food offerings for the students whenever possible. This increases student intake of fruits and vegetables (Ober Allen et al., 2008) and will create a stronger school community.
5. Lack of time is cited as the number one barrier to teachers using the garden. Adequate teacher training, as mentioned above, will help teachers to seamlessly incorporate the garden into the daily curriculum thereby keeping the garden from feeling like something extra that needs to be used. Schools need to assign designated personnel for garden upkeep and maintenance. If the budget does not permit adding another person to focus on the garden, volunteers or garden experts should be utilized to take the burden of maintenance from teachers (Thorp and Townsend, 2001). Communication with the community about the needs of the garden and its upkeep is key in gaining support and volunteers (Burt et al., 2018).
6. Initial funding is readily available for the creation of a school garden; however, the funding often stops at the initial phase thereby making the garden, garden supplies, and its upkeep a barrier to the school and teachers. Partnerships with local corporations,

school fundraisers, and grants should all be considered for funding. Funds from the nonprofit school food service account can also be used to purchase supplies if the produce is sold or used in an educational lesson. The produce can also be sold, and the money deposited into the nonprofit school food service account (USDA, 2009). Schools need to appoint someone to oversee the financial aspects of the school garden and then be creative and intentional when looking for funding.

7. Schools need to enlarge the number of teachers using the school garden and the frequency with which they use it. A person should be appointed over the garden for organizing use and maintenance, however, student instruction and garden use should not be left to just one person. For a school garden to be successful and sustainable, most if not all teachers need to be using the garden with students. Using local organizations such as Extension Services or professional development to train teachers in best practices for garden use should give teachers the training needed to understand how to incorporate the garden into their daily curriculum and encourage use with classes (Thorp & Townsend, 2001).
8. State educational systems should consider school gardens to be an academic program and support it accordingly with curriculum development, professional development, staffing, and funding. This could alleviate many of the barriers facing schools with school gardens including lack of time (Thorp & Townsend, 2001), lack of funding (Burt et al., 2018), and teacher training (Blair, 2009).

Recommendations for Research

School gardens have proved beneficial to students and schools, but barriers often prevent them from becoming successful and sustainable. This study sought to understand the teacher's

attitude and beliefs about the garden and how that impacts the garden use. From the data collected in this study, the following recommendations can be made for future research:

1. While the Extended Technology Acceptance Model (TAM2) was used to design the study survey, it states that positive attitudes toward the technology adoption should positively influence the behavior and use of the new technology (Venkatesh & Davis, 2000). The survey shows that the positive attitudes and beliefs exist in the survey participants, however, this is not translating to usage behavior needed to encourage success and sustainability in the school garden. A study should be done to focus on the barriers of the school gardens and how they have been successfully overcome by schools with long lasting, sustainable gardening programs.
2. Understanding best practices for the adoption of educational programs in schools will benefit the creation and success of school gardens. The lack of professional development and follow up support in all educational programs that are adopted needs to be studied and addressed. Training teachers in how to use the school garden in student instruction is necessary for usage and the success of the school garden (Landry & Logue, 2017). Research has shown that those teachers who do receive adequate training use the garden more effectively and give students the opportunity to gain benefits created by the holistic learning created by the garden (Skelly & Bradley, 2000). A large study dedicated to the successful adoption of school gardening programs would help in creating a program that helps other schools to create and adopt a program.
3. Elicitation studies are designed to understand a specific group and gather communal terminology that can be used in larger studies (Fishbein & Manfredo, 1992). A larger quantitative study should be designed using the words and attitudes of the teachers in this

study to better understand the needs of teachers in relation to the school garden. This data can then be used to design professional development and training that fits the unique needs to teachers who have access and use school gardens (Middlestadt et al., 1996). The use of social media to recruit survey participants may have resulted in a more positive outlook toward the school garden as those who were more willing to take time to complete the survey use and understand the benefits of the garden. Studies need to focus on whole schools to better understand the attitude and beliefs of all teachers, not just those that have a positive viewpoint of the garden.

4. Research shows that there is a positive impact on social/emotional health and wellbeing through use of the school garden (Thorp & Townsend, 2001) and data collected through this study supports that research. Research should be conducted on how to intentionally incorporate school gardens into existing counseling programs.

Conclusion

School gardens have been used in formal learning in the United States since the late 1800s. Today, they continue to be a beneficial learning tool in schools, offering benefits to students that range from academic achievement to social/emotional growth. This elicitation study used the Extended Technology Acceptance Model (Venkatesh & Davis, 2000) to determine how the attitudes and beliefs of teachers toward the school garden translated to the success of the garden. Understanding the attitudes and beliefs of the teachers in relation to the school garden is important in the success and sustainability of the garden program and the creation of adoption strategies to increase the likelihood of success and sustainability. This elicitation study provided insight into the thoughts and attitudes of teachers with school gardens and provided recommendations for future studies in relation to the sustainability of school garden programs.

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Appendix A

Social Media Advertisement

Appendix B

Institutional Review Board

Auburn University Human Research Protection Program

EXEMPTION REVIEW APPLICATION

For information or help completing this form, contact: **THE OFFICE OF RESEARCH COMPLIANCE,**
Location: 115 RamsayHall **Phone:** 334-844-5966 **Email:**IRBAdmin@auburn.edu

Submit completed application and supporting material as one attachment to IRBsubmit@auburn.edu.

1. PROJECT IDENTIFICATION **Today'sDate** October 19, 2020

a. Project Title Elicitation of Teacher Beliefs Related to School Garden Experiences

b. Principal Investigator Shelaine Davis Taylor Degree(s) Ph.D. Admin. & Supervision of Curriculum
Rank/Title Student Department/School College of Education
Phone Number (334) 313-3996 AU Email sdt0027@auburn.edu

Faculty Principal Investigator (required if PI isastudent) Lisa A. Kensler, Ed.D.
Title Professor Department/School College of Education/ Educational Leadership
Phone Number (334) 844-3020 AU Email lak0008@auburn.edu

Dept Head James Satterfield Department/School Department of Ed. Foundations, Leadership, and Tech.
Phone Number (334) 844-3060 AU Email jws0089@auburn.edu

c. Project Personnel (other PI) - Identify all individuals who will be involved with the conduct of the research and include their role on the project. Role may include design, recruitment, consent process, data collection, data analysis, and reporting. Attach a table if needed for additionalpersonnel.

Personnel Name Degree (s)
Rank/Title Department/School
Role
AU affiliated? ☐ YES ☐ NO If no, name of home institution
Plan for IRB approval for non-AU affiliatedpersonnel?

Personnel Name Degree (s)
Rank/Title Department/School
Role
AU affiliated? ☐ YES ☐ NO If no, name of home institution
Plan for IRB approval for non-AU affiliatedpersonnel?

Personnel Name Degree (s)
Rank/Title Department/School
Role
AU affiliated? ☐ YES ☐ NO If no, name ofhome institution
Plan for IRB approval for non-AU affiliatedpersonnel?

d. Training - Have all Key Personnel completed CITI human subjects training (including elective modules related to this research) within the last3 years? YES ☑ NO ☐

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e. **Funding source** - Is this project funded by the investigator(s)? ☑ YES ☐ NO
Is this project funded by AU? ☐ YES ☑ NO If YES, identify source _____
Is this project funded by an external sponsor? ☐ YES ■ No If YES, provide the name of the sponsor, type of sponsor (governmental, non-profit, corporate, other), and an identification number for theaward.
Name_____Type_____Grant # _____

f. List other IRBs associated with this research and submit a copy of their approval and/orprotocol.

N/A

2. Mark the category or categories below that describe the proposedresearch:

☐ 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices. The research is not likely to adversely impact students' opportunity to learn or assessment of educators providing instruction. 104(d)(1)

■ 2. Research only includes interactions involving educational tests, surveys, interviews, public observation if at least ONE of the following criteria. (The research includes data collection only; may include visual or auditory recording; may NOT include intervention and only includes interactions). **Mark the applicable sub-category below (I, II, or III).**104(d)(2)

■ (i) Recorded information cannot readily identify the participant (directly or indirectly/linked); **OR**
- surveys and interviews: no children;
- educational tests or observation of public behavior: can only include childrenwhen investigators do not participate in activities being observed.

☐ **(II)** Any disclosures of responses outside would not reasonably place participant at risk; **OR**

☐ **(III)** Information is recorded with identifiers or code linked to identifiers and IRB conducts limited review; no children. **Requires limited review by theIRB.***

☐ 3. Research involving Benign Behavioral Interventions (BBI)** through verbal, written responses (including data entry or audiovisual recording) from adult subjects who prospectively agree and ONE of the following criteria is met. (This research does not include children and does not include medical interventions. Research cannot have deception unless the participant prospectively agrees that they will be unaware of or misled regarding the nature and purpose of theresearch)
Mark the applicable sub-category below (A, B, or C). 104(d)(3)(i)

☐ **(A)** Recorded information cannot readily identify the subject (directly or indirectly/linked); **OR**

☐ **(B)** Any disclosure of responses outside of the research would not reasonablyplace subject at risk; **OR**

☐ **(C)** Information is recorded with identifiers and cannot have deceptionunless participant prospectively agrees. **Requires limited review by theIRB.***

☐ 4. Secondary research for which consent is not required: use of identifiable information or identifiable bio-specimen that have been or will be collected for some other 'primary' or 'initial' activity, if one of the following criteria is met. Allows retrospective and prospective secondary use. **Mark the applicable sub-category below (I, II, III, or Iv).** 104(d)(4)

☐ (i) Biospecimens or information are publicly available;

☐ (ii) Information recorded so subject cannot readily be identified, directly or indirectly/linked; investigator does not contact subjects and will not re-identify the subjects; OR

☐ (iii) Collection and analysis involving investigators use of identifiable health information when use is regulated by HIPAA "health care operations" or "research or "public health activities and purposes" (does not include biospecimens (only PHI and requires federal guidance on how to apply); OR

☐ (iv) Research information collected by or on behalf of federal government using government generated or collected information obtained for non-research activities.

☐ 5. Research and demonstration projects which are supported by a federal agency/department AND designed to study and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs;(iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs. (must be posted on a federal web site). 104(d)(5) (must be posted on a federal web site)

☐ 6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture. The research does not involve prisoners as participants. 104(d)(6)

New exemption categories 7 and 8: Both categories 7 and 8 require Broad Consent. (Broad consent is a new type of informed consent provided under the Revised Common Rule pertaining to storage, maintenance, and secondary research with identifiable private information or identifiable biospecimens. Secondary research refers to research use of materials that are collected for either research studies distinct from the current secondary research proposal, or for materials that are collected for non-research purposes, such as materials that are left over from routine clinical diagnosis or treatments. Broad consent does not apply to research that collects information or biospecimens from individuals through direct interaction or intervention specifically for the purpose of the research.) **The Auburn University IRB has determined that as currently interpreted, Broad Consent is not feasible at Auburn and these 2 categories WILL NOT BE IMPLEMENTED at this time.**

***Limited IRB review* - the IRB Chairs or designated IRB reviewer reviews the protocol to ensure adequate provisions are in place to protect privacy and confidentiality.**

****Category 3 – Benign Behavioral Interventions (BBI)* must be brief in duration, painless/harmless, not physically invasive, not likely to have a significant adverse lasting impact on participants, and it is unlikely participants will find the interventions offensive or embarrassing.**

3. PROJECT SUMMARY

a. Does the study target any special populations? (Mark applicable)

Minors (under 18 years of age)	☐ YES ☑ NO
Pregnant women, fetuses, or any products of conception	☐ YES ☑ NO
Prisoners or wards (unless incidental, not allowed for Exempt research)	☐ YES ☑ NO
Temporarily or permanently impaired	☐ YES ☑ NO

b. Does the research pose more than minimal risk to participants? ☐ YES ☑ NO

Minimal risk means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or test. 42 CFR 46.102(i)

c. Does the study involve any of the following?

Procedures subject to FDA regulations (drugs, devices, etc.)	☐ YES ☑ NO
Use of school records of identifiable students or information from instructors about specific students.	☐ YES ☑ NO
Protected health or medical information when there is a direct or indirect link which could identify the participant.	☐ YES ☑ NO
Collection of sensitive aspects of the participant's own behavior, such as illegal conduct, drug use, sexual behavior or alcohol use.	☐ YES ☑ NO
Deception of participants	☐ YES ☑ NO

4. Briefly describe the proposed research, including purpose, participant population, recruitment process, consent process, research procedures and methodology.

The purpose of this study is to elicit teachers' attitudes and beliefs associated with their school garden and how these may influence school garden success. Participants will include teachers who have access to and use social media, teach in the United States at any grade level (pre-K through 12th), and currently work at a school with a garden or have in the past 5 years. Participants will be recruited through various social media, e.g. Facebook, Twitter, and Instagram, using advertising services if available. Social media groups that pertain to school gardens will be approached via social media and hashtags such as #schoolgarden will be used to distribute the survey to a wider audience. The survey introduction explains that it is voluntary, participants may exit the survey at any time, and no identifying data will be collected. The survey was created in Qualtrics and contains 32 open-ended questions. Data collection will be done digitally through Qualtrics and then coded using In Vivo coding. The codes will then be mapped to determine more concise categories.

5. Waivers

Check any waivers that apply and describe how the project meets the criteria for the waiver. Provide the rationale for the waiver request.

- ☐ **Waiver of Consent (including existing de-identified data)**
- ☑ **Waiver of Documentation of Consent (Use of Information Letter)**
- ☐ **Waiver of Parental Permission**

All retrospective information will be de-identified.

The introduction to the Qualtrics survey will state that no identifying data is being collected and participation is voluntary. The participant may exit the survey at any time by simply closing the survey.

6. Describe how participants/data/specimens will be selected. If applicable, include gender, race,and ethnicity of the participant population.

Selection of participants will be done through social media and the sample criteria includes the following:

- Teachers who have access to and use social media
- Teachers in the United States at any grade level (pre-K through 12th)
- Teachers who teach or have taught at a school with a school garden within the last five years

7. Does the research involvedeception? ☐ YES ☒ NO If YES, please provide the rationale for deception and describe the debriefing process.

8. **Describe why none of the research procedures would cause a participant either physical or psychological discomfort or be perceived as discomfort above and beyond what the person would experience in daily life.**

This study seeks to elicit attitudes and beliefs from teachers about a school garden. The anonymous data will be collected with no identifying information so there should be no worry about any recourse from school administrators. The means of collecting the anonymous data is an open-ended Qualtrics survey that is voluntary and may be closed at any time. No question is disturbing or directly upsetting for participants.

9. **Describe the provisions to maintain confidentiality of data, including collection, transmission, and storage.**

All data is anonymous and no identifying data is collected in the survey. All data will be collected through Qualtrics and stored in their data and analysis section. Coding will be done on the researcher's personal computer that is password protected.

10. Describe the provisions included in the research to project the privacy interests ofparticipants (e.g., others will not overhear conversations with potential participants, individuals will not be publicly identified or embarrassed).

Individuals will not be asked any qualifying data that could identify them or the school at which they work. This deters any retribution or embarrassment that could be had by collected information being released in writing. All data is anonymous and cannot be traced to the participants.

11. Will the research involve interacting (communication or direct involvement) with participants?
☒ YES ☐ NO If YES, describe the consent process and information to be presented tosubjects. This includes identifying that the activities involve research; that participation is voluntary; describing the procedures to be performed; and the PI name and contact information.

Research participants will be given a link through the social media advertisement or post that will direct them to the survey. Participation is voluntary. If the participant chooses to proceed to the link, they will be directed to the survey. An introduction letter detailing that the survey is voluntary and may be exited at any time will then be presented to the participant. The introduction also states that there is no identifying data collected through the survey and that the data will be used to complete an educational degree requirement. The PI name and contact information (Shelaine Taylor, sdt0027@Auburn.edu, (334)313-3996) is present on the introduction letter.

12. Additional information and/or attachments.

In the space below, provide any additional information you believe may help the IRB review of the proposed research. If attachments are included, list the attachments below. Attachments may include recruitment materials, consent documents, site permissions, IRB approvals from other institutions, etc.

Please see the following attachments:

- Survey Introduction
- Recruitment ad for social media
- Survey
- CITI training certificates

Principal Investigator's Signature Shelaine Taylor **Date** 10/19/20

If PI is a student,
Faculty Principal Investigator's Signature [signature] **Date** 10/22/20

Department Head's Signature James Satterfield **Date** 10/26/2020

Appendix C

Informed Consent

Elicitation of Teacher Beliefs Related to School Garden Experiences

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS IRB APPROVAL INFORMATION WITH CURRENT DATES HAS BEEN ADDED TO THIS DOCUMENT.)

You are invited to participate in a research study that explores your experience with school gardens. The study is being conducted by Shelaine Taylor, doctoral student, under the direction of Lisa Kensler, EdD, in the Auburn University Department of Educational Leadership. You are invited to participate because you are teacher who has access to a school garden and are age 19 years of age or older.

What will be involved if you participate? Your participation is completely voluntary. If you decide to participate in this research study, you will be asked to complete a survey on school garden use. Your total time commitment will be approximately 20 minutes.

Are there any risks or discomforts? The risks associated with participating in this study are nominal. To minimize these risks, we will maintain participant anonymity. No identifying information will be collected.

Are there any benefits to yourself or others? If you participate in this study, you can expect to contribute to research related to school gardens. I cannot promise any direct benefits to you personally.

Will you receive compensation for participating? You will not receive compensation for completing the survey.

Are there any costs? There are no costs involved with completing the survey.

If you change your mind about participating, you can withdraw at any time by closing your browser window. We are only collecting anonymous data. Once you've submitted anonymous data, it cannot be withdrawn since it will be unidentifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the College of Education, or the Department of Educational Foundations, Leadership, and Technology.

Any data obtained in connection with this study will remain anonymous. Information collected through your participation will be used to fulfill an educational degree requirement as well as contribute to professional research publications.

If you have questions about this study, please contact Shelaine Taylor at (334) 313-3996 or sdt0027@auburn.edu. You may also contact my faculty advisor, Dr. Lisa Kensler, at (334) 844-4460 or lak0008@auburn.edu.

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If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334) 844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

Thank you for your time and consideration.
HAVING READ THE INFORMATION ABOVE, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, PLEASE CONTINUE TO THE SURVEY.

YOU MAY PRINT A COPY OF THIS LETTER TO KEEP.

Shelaine Taylor 10/19/2020
Investigator Date

The Auburn University Institutional Review Board has approved this document for use from_____to_____. Protocol #_____

Version Date (date document created): October 19, 2020

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Appendix D

Invitation to Participate

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Appendix E

School Garden Survey

The Qualtrics Survey can be found at the following link:
https://auburn.qualtrics.com/ife/form/SV_ewICFcRdKTagcTz

1. Does your school currently have a garden or has it had a garden in the past five years while you were employed there? *If the teacher replies no, the survey will remove them from the survey at this point.
2. In what state is your school located?
3. If your school currently has a garden or has had a garden in the past five years, how long has/had it been operating and in use?
4. If your school currently has a garden or had one in the past five years, approximately how often do/did you use it with students?
5. What roles have you held in your school within the last five years? If you are a teacher, please list all subjects that you teach or have taught in the past five years at your current school.
6. How many years have you been in your current role?
7. How many years total have you worked in schools?
8. What experience do you have with school gardens?
9. What experience do you have with gardening outside of school?
10. What is the view of the school administration on the use of the school garden?
11. What is the stance of the school district on the use of the school garden?
12. Who within your school and/or district supports the use of the school garden?
13. Who within your school and/or district opposes the use of the school garden?
14. What is your view on the use of the school garden?
15. How do people in your school describe or talk about teachers who use the school garden?
16. What influence does the garden have on how the community views the school?
17. How does the school garden relate to the classes and curriculum you teach?
18. How does the school garden affect students' learning in your classes?
19. What, if any, do you believe are the benefits of using the school garden? Please explain any benefits.
20. What, if any, do you believe are the barriers of using the school garden? Please explain any barriers.
21. Is garden use voluntary or mandated in your school?
22. Who decides if teachers are required to use the school garden?
23. Approximately what percentage of teachers do you believe utilize the garden at your school?
24. How is the garden used in other ways besides instruction?
25. What is the usefulness of the school garden in instruction and student learning, if any?
26. What is the usefulness of the school garden beyond instruction and student learning, if any?
27. Does the garden increase your effectiveness as a teacher and if so, how?
28. Describe the ease of using the garden in student instruction.
29. Describe the difficulty of using the garden in student instruction.
30. What training did you receive on how to best use the school garden with students?
31. Approximately how much time was spent in training teachers on how to best use the garden at your school?