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DIGGING INTO GARDENING IN ELEMENTARY CLASSROOMS

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Abstract
Garden-based learning (GBL) presents meaningful content using experiential learning which may improve student engagement. Stemming from an overarching concept of engagement, this paper focuses on the classroom-based pedagogy of experiential learning. It includes extracts of several garden-based practices, benefits of integrating GBL into the curriculum- including improved classroom climate and increased pro-environmental attitudes, and research conducted to explore elementary teachers' perspectives on and experiences with garden-based learning. Suggestions for implementing gardens in elementary schools are included. Overall, this paper supports existing theories connecting garden-based learning to authentic education and positive child growth.

Keywords
Garden-based learning (GBL), experiential learning, pro-environmental attitudes

Peer Review
This work has undergone a double-blind review by a minimum of two faculty members from institutions of higher learning from around the world. The faculty reviewers have expertise in disciplines closely related to those represented by this work. If possible, the work was also reviewed by undergraduates in collaboration with the faculty reviewers.

Digging into Gardening in Elementary Classrooms

Garden-based learning can transform the traditional elementary classroom into a living laboratory. It can cultivate academic success, motivate students to engage with content, and produce environmentally adept learners. The mode of instruction, like curriculum content, has shifted to best reflect the current cultural, social, and economic values of today (Subramaniam, 2002). Classroom climate is an important factor in both the experiential learning experience and student engagement with content. Classroom climate contributes to students' interest, motivation to learn, and academic achievement. Teachers control the classroom climate which Hugerat (2016) defined as "the learning environment that the instructor creates by teaching using a teacher-centered or learner-centered approaches" (p. 384). A positive and supportive classroom environment correlates to student success. The philosophy of experiential and naturalistic education integration is on the upsurge. Subramaniam (2002) defined experiential education as "a process through which a learner constructs knowledge, skill, and value from direct experiences" (p. 3). Through amalgamated curriculum as well as the paradigm of environmental education and agricultural literacy, there is a new context for basic instruction beyond school classrooms, the school garden.

School gardening may be the epitome of academic enrichment. A school garden is a place where students can learn about nutrition, food security, cultural differences, and ecological sustainability. The benefits of gardening may carry over into the classroom. Fifth grade students who participated in school gardening activities scored significantly higher on science achievement tests than students without garden curriculum (Klemmer et al., 2005). Additionally, research has shown that students who learn in nature perform better than students who learn exclusively indoors (Kuo et al., 2018). With students happily engaged in conceptual development, fewer behavioral issues may arise. Kuo et al. (2018), suggested that lessons about nature (while outdoors) have a positive effect on subsequent classroom management. If teachers spend less time redirecting or refocusing their students, they may become engaged with their learning since it is personal and experiential. The elementary classroom should be a place of inspiration where students connect their academic life to personal experiences and feelings to encourage strong educational development. Using multicultural approaches in the classroom helps students to accept and own their heritage. Gardening provides a cultural connection to food, environmental practices, medicines, and world religions onto school grounds (Sloan, 2013). Place-based learning provides an opportunity for a reformed or transformative curriculum. This methodology enhances students' feelings, advocating for an affective approach to place, culture, and the learning experience. Educators that employ pedagogical approaches that accelerate knowledge acquisition of place-based learning and culture amplify students' overall understanding of cross-curricular content knowledge. Teachers hold the expectation for learning and must exemplify positive attitudes towards nature-based learning (Sloan, 2013).

When teachers demonstrate a pro-environmental attitude, accompanied by identical morals, elementary schools have shown improvement in their culture, behavior, and support for garden-based integration for their teachers (Pérez-López et al., 2020). Garden-based learning develops an affection, attachment, and an attentiveness toward nature. Once students can become connected with the content, in this case a garden, then their emotional and attitudinal feelings may transform into pro-environmental actions (Pérez-López et al., 2020). Based on Edward Deci's self-determination theory, Skinner et al. (2012) explained how garden-based education and student motivation are intertwined. "Most important, gardening introduces activities that are authentic and meaningful, potentially instilling pride and ownership. This supports autonomy, a need that is increasingly important and increasingly undermined by schooling as students approach adolescence" (p. 19).

According to Sloan (2013), "teachers are the guides who assist learners on their educational journey through the realms of academia and beyond" (p. 28). Classrooms represent an environment of learning that serve to inspire students to append their educational experiences to authentic situations (Sloan, 2013). Garden-based learning may help to develop a child's creativity, sense of wonder, and appreciate of beauty thus helping their environmental attitudes blossom (Ernst et al., 2012; Fisher-Maltese et al., 2015; Passy, 2014; Skinner et al., 2012).

Benefits of Garden-Based Learning

When children are given the opportunity to assist in the planning of a school garden, then they develop close, intimate relationships and experiences with the Earth (Blair, 2009). Passy (2014) described an interview with an elementary teacher who explained how encouraging gardening led to a positive shift in numerous behaviorally inept male students. With the distraction of students getting their hands dirty, these boys were able to talk about things they were weighing heavily on their chest. As a result, there was a delightful change in behavior, thus leading to fewer behavioral outbursts in the future (Passy, 2014). According to the Department for Education and Skills (2003), "children learn better when they are excited and engaged . . . when there is joy in what they are doing, they learn to love learning" (p. 3). When teachers took into account students' interests through providing enjoyable stimuli then, standards, measured in test scores, rose (Passy, 2014).

Through garden-based activities Skinner et al. (2012) found that the quality or extent to which students participated in gardening lead to a captive classroom that exhibited on-task behavior and emotional zeal about learning. Gardening gives students a purpose as to why they are in school and manifests the value of learning about science (Klemmer et al., 2005). Kuo et al. (2018) argued that lessons in nature have positive, instantaneous effects on students, thus influencing classroom engagement. Finally, creating a garden can have a positive effect on an elementary school's culture and community, as students, faculty, staff, and visitors enjoy the beauty of the effort (Passy, 2014).

Additional benefits to garden-based learning can be considered in terms of three main factors:

- **classroom climate** – refers to the prevailing moods, attitudes, tone, and standards that the teacher and students feel when in the classroom (Hugerat, 2016).
- **environmental attitudes** – the degree to which individuals or communities value and respect nature, ecology, or environmental concerns (Ernst et al., 2012).
- **teaching strategies** – refer to the methods of differentiation used to assist students in retaining and learning the desired curriculum (DeMarco, 1999).

Classroom Climate

Classroom climate can be defined as "the intellectual, social, emotional, and physical environments in which our students learn" (Ambrose et al., 2010, p.170). If not addressed properly- within an appropriate amount of time, correct intonation, level of privacy- then the classroom climate may be negatively affected and subsequently negatively influence a student's achievement in school (Hirschy et al., 2004). Hugerat (2016) argued that learning science through project-based learning positively affects students' perceptions of the science classroom climate. The mode for excellent schooling is dependent on what happens outdoors since that is where life grows and transforms. Science conceptual development is enhanced by conducting experiments and using inquiry skills to create scientific explanations. These activities and skills can be applied to the garden as it requires an abundance of data collection and analysis, identifying relationships among nature (Wu, 2010). After conducting a qualitative study involving 458 ninth grade students, Hugerat (2016)

found that students who learned science through project-based teaching had a higher appreciation regarding their classroom learning environment. This garden-supported classroom's climate included greater teacher supportiveness, more positive teacher-student relationships, and enjoyable conceptual development.

Environmental Attitudes

Environmental attitudes are defined as "a psychological tendency expressed by evaluating the natural environment with some degree of favor or disfavor" (Fisher-Maltese et al., 2015, p. 52). Gardens aid in increasing environmental awareness by providing students the ability to form positive environmental attitudes and develop curiosity through experiential learning. Moreover, children who interact in nature together have more positive feelings towards each other (Ernst et al., 2012). Fisher-Maltese et al. (2015) supported the significant role that school gardens play in impacting student attitudes toward the environment. According to Sloan (2013), "place-based learning heightens a learner's awareness of their role and connection to culture and ecosystems" (p. 28). By using a school garden as a spring board for building a connection to the natural world, students may be able to simultaneously develop their environmental attitudes and science conceptual understanding.

Gardens and Elementary School Content Areas

When writing about school gardening, Subramaniam (2002) reported how garden-based learning helped students improve their contextual, integrated learning, and critical thinking skills. Gardening benefits the students by inspiring new ideas of learning and allowing them to solve new problems (Klemmer et al., 2005). Garden-based learning creates memorable and meaningful hands-on learning opportunities that integrate core curriculum with experiential learning (Cramer et al. 2019; Subramaniam, 2002). A feeling of awe and wonder should be the focus of educational experiences, while teaching is a methodical practice, creativity makes the process seem extraordinary (Sloan, 2013). Western Growers Foundation (2006) provided a simple guideline for integrating gardening with classroom curriculum. First, begin with research, which should focus on aligning the state standards with curriculum goals. Then, make a list or content map with the targeted subjects. Next, design and develop learning activities that will support student achievement levels related to the standards. Garden-based learning provides an environment where education through play creates a redefined philosophy of curriculum (Dennis et al., 2014).

Science

Gardening is a laudable approach to teaching science. It makes the content inviting while providing remarkable connections to students' lives. Gardening inspires active learning and exploration, it evokes abstract thinking, inquiry, and problem solving (Western Growers Foundation, 2006; Ernst et al., 2012; Wu et al., 2010). Possible science activities to try while in the garden include observing the life cycles of plants, dissecting/labeling the parts of a flower, observing flower reproduction, or observing the process of pollination and creating habitats, like a bee house or lizard lair, for native species.

Mathematics

Similar to science, gardening is a commendable approach to teaching mathematics. Gardening yields numerous opportunities to practice foundational math skills like calculations, comparisons, measurements, and data representation (Western Growers Foundation, 2006). Through garden-based instruction, students can visualize math in a practical and authentic manner (Western Growers Foundation, 2006; Skinner, et al., 2012; Klemmer et al., 2005). Content becomes relevant when students can utilize what they've learned in class in a real-life setting (Western Growers Foundation, 2006). Possible math activities vary by student age, but may include measuring

the growth rate of plants, then displaying the data on appropriate graphs, measuring the garden parameters, calculating the perimeter and area, and determining the volume of water needed to properly treat the garden.

Methodology

To better understand teachers' commitment, involvement, and experience with school gardens, a K-5 elementary school in the Southeastern United States, serving 914 students, was chosen as the site for this action research project. Within this county of 45 elementary schools, only 11, including one k-8 charter school, have gardens on-site (Volusia County, News Article, 2019). The school site was selected out of convenience. It was the location of the author's student teaching placement. The school has a staff of 39 classroom teachers. Of those 39 teachers, three self-reported using the on-site garden. Those three teachers agreed to complete a brief, anonymous survey about their perceptions of gardening in the elementary school. Teachers volunteered to complete the survey and were not offered incentives for completion. Two teachers responded and provided the feedback imbedded in this piece.

The surveys included questions about garden use, student reactions, belief in garden-based learning, and advice to novice teachers. Survey responses were used to develop the idea that school gardens are necessary, doable, and worthwhile. The following questions were asked on the survey:

1. What did you use the garden for?
2. What subjects, if any, did you explore using the garden?
3. How did the students react while working in or near the garden? How do you know they felt that way?
4. Why did you stop using the garden? Would it be feasible for you to use it now?
5. Do you believe in the benefits of garden-based learning (lower stress, better cooperation among students, positive environmental attitudes, etc.)? Why or why not?
6. What advice would you give to a novice teacher about utilizing gardening in elementary schools?

Survey Results

Due to the small nature of the sample size, results from this survey are not generalizable. Rather, results can be shared to engage educators in conversation and evaluation about how, and if, school gardens could support their students' learning experiences.

Both teachers reported using the garden for lessons, educational activities, and a break from being indoors. One teacher reported using the garden as a "cool-down" spot which is a designated space where students can go when they are feeling overwhelmed or upset. Another teacher revealed that they created a gardening club at their school with a fellow teacher. As mentioned previously, both participants utilized the garden as a means to educate their classes. The subjects explored while in the garden were writing, social studies, math, both teachers admitted using the garden for ELA/reading and science. One teacher noted that "All grade levels can find ways to incorporate the garden into their curriculum."

When asked how students responded to working in the garden the consensus was that students "truly enjoyed" being outside and "loved being able to see the changes in the garden, watching things grow, and be a part of the process." These teachers detailed three principle reasons as to why they stopped using the garden they are as follows: insufficient amount of time, maintaining the garden, and lack of support. The teachers credit garden-based learning for opening learning opportunities and providing a new environment for students to "explore and investigate."

Further, garden-based learning has proven to increase students' vegetable consumption and aid in teaching about proper nutrition (Blair, 2009; Cramer et al., 2019; Fisher-Maltese et al., 2015; Klemmer et al., 2005 Skinner et al., 2012;). One teacher described a student who picked and ate their first carrot from the garden calling it, "yummy."

Finally, the advice that both teachers shared to novice educators was to "start small." They believe in the benefits of garden-based learning and suggested finding a volunteer for support on bigger projects. For a program that the "whole school benefits from" why is it such a struggle to wrangle communal and administrative support and why do so many teachers opt out of using the garden?

Discussion

Building a class or school garden can capture students' curiosity, advance critical thinking skills through hands-on problem solving, develop autonomy and environmental awareness, and the impact the classroom climate. However, teachers who do not classify as "gardeners" may be less likely to utilize the school's garden. Therefore, gravitating toward the traditionalist and comfortable classroom activities teachers are familiar with, even though, the use of place-based learning has shown to increase student engagement and motivation (Sloan, 2012). Blair (2009) suggested that teachers need more training in order to effectively use gardening as a teaching tool. Moreover, there have been multiple case studies, interviews, and questionnaires that report that "there is a clear demand for exposure to garden-based learning among preserve teachers" (Cramer et al., 2019) (p. 67). However, due to the absence of garden-based courses offered in teacher preparation programs, many teachers lack the preparation and confidence to constructively integrate gardening into their pedagogy and subsequently affect the development of students' autonomy (Blair, 2009; Cramer et al., 2019; DeMarco, 1999).

Next, teachers have the onus to revitalize education for each generation of students. Moreover, educators must provide instruction that is relevant, effective, and socially engaging for all students. Heins et al. (2003) found that, "the enthusiasm and learning success (for students of every ability level) were important reminders that nontraditional educational settings are an effective way to reach all kinds of students" (p. 26). This statement embodies the necessity of integrating progressive and non-traditional methods into elementary classrooms as well as building the current generation of learners' critical thinking skills.

Lastly, teachers should utilize experiential learning in elementary classrooms. Experiential learning has shown to increase student motivation, engagement, and different play behaviors (Dennis et al., 2014). School campuses yield the grounds for becoming teaching labs that can provide meaningful and authentic learning at a low cost, like a school garden (DeMarco et al., 1999). As noted by the survey research, garden-based learning successfully reduces academic fatigue among children and bring joy back to teaching and learning. Furthermore, teachers agree that garden-based learning is a laudable approach to modern teaching and is worth the foreseeable challenges. This type of teaching may have an initial resistance since today's generation of students are not used to using their creativity in school, so it may take some time to restructure their attitudes and develop their curiosity toward unknown subjects.

Steps to Starting a School Garden

Developing an academic and sustainable school garden is a project that must be meticulously detailed. It requires a great deal of attention and planning before the act of gardening can even take place. Interaction with natural materials, such as, sticks, mud, stone, and sand are shown to increase student engagement, cooperation, and different play behaviors (Dennis, 2014). Below are steps to starting a school garden, modeled after Becky Griffin, Extension Community and School Garden

Coordinator and David Knauft, University of Georgia Emeritus Professor of Horticulture's approach to a successful implementation.

1. **Assemble a team**

School gardens begin with community (Firth et al., 2011; Florida Department of Agriculture and Consumer Services, 2019). Creating a garden requires a tremendous amount of help. Gathering support from fellow teachers and staff will promote a positive agrarian attitude throughout the school, thus making it easier to implement a new project. It is imperative for the administrative staff to be aware of any projects happening on school grounds. So, teachers must clearly communicate the gardening goals and aspirations while developing a committee of progressive teachers from different backgrounds (grade levels, gender, race, etc.). It is necessary to include all members of a school; custodians, cafeteria workers, paraprofessionals, parent volunteers; a diverse gardening team allows for greater accessibility to various resources and skills **(**Griffin et al., 2016; Florida Department of Agriculture and Consumer Services, 2019).

The pre-established committee should decide what type of garden they envision the school to produce. Additionally, the committee should meet to discuss how they plan to incorporate garden-based practices into their curriculum. Science evidently ties into garden-based learning as it requires inquiry skills- students can study organisms, life cycles, plant anatomy, decomposition, pollination, diversity of life, etc. However, gardening-based practices are not limited to just science.

2. **Devise a plan**

Griffin et al. (2016) suggested visiting a local school that has a successful garden already in place. The reason being that it may spark creativity and give the gardening team ideas of what to do and what not to do. The next step is to draft the gardening plan, but first teachers must answer this question: What is the ultimate goal in implementing a garden in the school? This will drive the focus and guide ideas into becoming a reality.

Develop a plan that includes:

- **A material list**: What tools are necessary for success? Estimate necessities like shovels, gloves, safety gear, plants/seeds, compost, raised bed supplies, fencing, and signage.
- **Types of plants**: Will the team be buying local/native plants? Will the team be planting produce?
- **Budget**: How much will this project cost? Who is paying for it? Will the team apply for grants?
- **Timeline**: How long will this project take? (Realistically a year: September-July/August)
- **Time requirements**: Is there a schedule for maintenance? Decide how much time is required from teachers, staff, and volunteers.
- **Personal needs**: How many people are needed to have a successful garden?
- **Garden space requirements**: Where will the garden be located and how big can it be?
- **Curriculum connections**: Do the garden-based practices align to the state standards?
- **Community support ideas**: How can the community be involved (volunteering, donating, construction)?

3. **Amass administrative support**

Schedule a time to meet with the administrative staff. Be sure to have an organized and detailed plan with a clear vision of what this project is to become. Administrators want to know how the presence of a garden will boon the students while not inconveniencing teachers **(**Griffin et al., 2016). Garnering the principal's support is necessary for the execution of this project, additionally,

the principal may be a valuable resource- suggesting possible members for the gardening team (Treadwell et al., 2019).

4. **Gather parent and community support**

Ideally, parents will want to be involved with the execution of a project of this depth. The Parent Teacher Association may have connections to the community that could benefit the garden. Additionally, parents can assist in gathering volunteers, accumulating support from the community, and organizing on-site workdays in the garden **(**Griffin et al., 2016; Florida Department of Agriculture and Consumer Services, 2019). A big gardening team allows for more ideas and skills to be shared, thus increasing the garden's short- and long-term success (Florida Department of Agriculture and Consumer Services, 2019).

Griffin et al. (2016) cited the successful use of "garden-angels" or "parent partners" in school gardens. The position is filled by a trained individual with a background in horticulture. The garden is a year-round commitment, so it is important to have dedicated individuals to help with garden care in the summer and during holidays. Realistically, one person alone cannot successfully groom and conserve the garden. Therefore, it is crucial to have a committee of parents and volunteers who can assist in the maintenance of the garden.

5. **Select a spot for the garden**

The decision as to where to place the school garden must be methodical and carefully considered. Think about the region's climate- what are summers like? Are winters harsh? Gardens thrive with proper irrigation, sunlight, and fertile soil. Survey the school and its resources. Can a traditional garden thrive on the school ground or should the team consider a shade garden? The key is to start small and grow over time, as the team builds knowledge, connections, and support. The Florida Department of Agriculture and Consumer Services (2019) suggested finding a location that is visible and highly trafficked by all members to ensure the success of the school's garden.

6. **Communicate with custodial and grounds staff**

Communication at all levels is critical for a prosperous garden. Notify the school's landscape/maintenance crew of any changes or adaptations being made to school grounds (Griffin et al., 2016). These workers have developed a routine of where to spray pesticides, herbicides, etc., so it is imperative to communicate what is and isn't accepted around the garden.

7. **Celebrate Success**

Now that the gardening team has completed the steps above, the team should be ready to move forward in implementing the school garden. Relish in knowing that each garden program is special and carries its own unique story (Florida Department of Agriculture and Consumer Services, 2019). So, grab some shovels, go outside, and begin growing the garden!

Garden-based practices have been shown to decrease behavioral problems and improve student attitude and motivation, because students are actively engaged (Kuo et al., 2018; Passy, 2014; Skinner et al., 2012). "Integrating gardening does not need to be complicated or frustrating, but rather an opportunity to work together as educators to expose students to this important aspect of life" (Lowry, 2011, p. 36). Through the implementation of garden-based practices Skinner et al. (2012) postulated that educators may teach more meaningful content, as a result, students may become more engaged with instruction.

Limitations of Implementing a School Garden

While there is a myriad of benefits to the implementation of school gardens, it is imperative to note the limitations. There are three common concerns surrounding the integration of garden-based learning in modern curriculum. Rickinson et al. (2004) identified these concerns in his categorization of 'barriers to outdoor learning'. First, there is great concern regarding the health and safety of students. Thomas (1999) exposed the communal impulse to overshadow the proven

educational benefits of experiential, offsite and outdoor learning due to the publicization of students being injured on school grounds. Lowry (2011), found that teachers grew anxious when trying to manage large numbers of students working in the garden. Second, Rickinson et al. (2004), described the lack of curricular materials linked to academic standards. Varying by region, some flowers show most proficient growth over the summer when students are not on campus so, the question arises as to why should schools fund a project with little to no academic enrichment? Contrarily, many teachers believe in the practice of garden-based learning, but are unsure how it fits into the curriculum, so they avoid using this methodology entirely (Lowry, 2011; Cramer et al., 2019; Rickinson et al., 2004). Finally, Rickinson et al. (2004) recognized the lack of time, resources, and support for garden-based learning as the third most pressing concern for effective integration. Principally, teachers have other priorities rather than learning to incorporate gardening, a subject in which they lack the pedagogical skills (Lowry, 2011). Furthermore, the Growing Schools evaluation underscored numerous barriers regarding funding, transportation, and parental costs (Scott et al., 2003).

Conclusion

Garden-based learning provides students with the opportunity to take control of their education. "School gardens are outdoor classrooms, writing laboratories and science observatories" (Florida Department of Agriculture and Consumer Services, 2019, p. 2). Societally, we are in a new era of teaching. We are modernizing classrooms with technology; however, we are still using a traditionalism approach in schools, although, current research cries for a reform in education. Moreover, garden-based learning fosters scholastic performance, student engagement, and environmentally adroit learners. Experiential learning provides teachers with a pedagogy that meets the rigor of a standard-focused educational system meanwhile students are able to participate in an engaged and meaningful way (Lake et al. 2015). Garden-based learning is experiential and requires students to use the knowledge they learn in the classroom and apply it to real-life. Lessons in nature, experiential education, and garden-based learning are paramount if there is any hope in creating the next generation of environmental stewards.

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