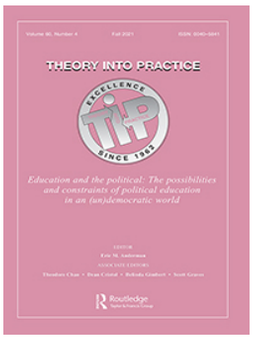

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How learning gardens foster well-being and development through the promotion of purposeful play in early childhood and beyond

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ABSTRACT

Play is essential to learning and development in the early childhood years. Young children experiment with new skills through play, which supports the development of new competencies and furthers cognitive development. Nontraditional learning spaces such as teaching and learning gardens provide excellent opportunities for children to engage in purposeful play that supports their well-being, cognitive and identity development, and promotes positive emotional experiences. Self-determination theory, cognitive psychology, and developmental psychology offer useful frameworks for understanding how play in school gardens can improve motivation and promote meaningful learning in the early childhood years and beyond. Benefits reported in the literature of incorporating school gardens into teaching and learning experiences include opportunities for learners to satisfy the basic psychological needs of autonomy, competence, and relatedness, increased positive emotions, opportunities to renew cognitive and emotional energies, and tangible evidence of efforts linked to initiative and industry of students who care for plants and animals in the garden. Recommendations include long-term planning for funding school garden programs and supporting teachers in incorporating purposeful play in the garden into learning.

Researchers such as Vygotsky, Piaget, and Parten have all argued the importance of play as an avenue for learning among young children (LeFrancois, 2020; Parten, 1932, 1933; Vygotsky, 1967). In early childhood, learning and play are interconnected rather than independent or mutually exclusive. Play allows young children to experiment with new skills and behaviors, practice novel tasks, and eventually master those skills, behaviors, and tasks. This cycle of trying and mastering new skills fosters cognitive development as children continuously seek to master more challenging and interesting tasks (Elkind, 1971). Nontraditional learning spaces such as school gardens, which increasingly operate as teaching and learning spaces, are rich with opportunities for early childhood educators to support purposeful play that fosters the development and well-being of their students. Research across multiple disciplines supports the use of gardens as a place for healthy learning and development in early childhood and beyond. Play that children engage in while in learning gardens supports healthy cognitive and identity development. Working in the gardens has added benefits for academic and social learning through authentic and purposeful play.

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We approach gardens as spaces of alternative learning through the discipline of geography. There, research recognizes learning gardens as spaces for children to cultivate their personhood as they encounter each other, non-human nature, and unfamiliar objects, such as tools, in less-structured ways than in the classroom (Moore et al., 2015). They are in-between spaces suspended between the rule-framed classroom space and the space beyond that carries some of those classroom rules but is also premised on social relations that connect children with nature. In this way we see learning gardens as places where children's natural instincts to play can be channeled into guided exploration where play becomes a purposeful avenue to learning. Learning garden spaces open opportunities where identities (who am I?) and interests (what draws my attention?) are in formation and filtered through new encounters (Merritt et al., 2021). Part teaching and learning context, part spaces of play and release, school gardens can best be conceptualized as a spaces of possibility and constant change where each day dawns on a landscape of surprise, joy, pleasure, and problems to be understood and resolved. Learning gardens are sites where theory and concepts are not abstractions but emerge from "doing" in a place of play and living inquiry.

In this article we draw upon self-determination theory, cognitive psychology, and developmental psychology within the context of an established learning garden program in a large Title I school district in Tucson that serves 45,000 students. Our understanding of learning gardens is based on more than a decade of research and experience as part of the University of Arizona's School Garden Workshop. The garden program subsidizes formal training for teachers to use gardens for learning activities based on purposeful play in early childhood and beyond. We have conducted numerous studies on the impact of learning gardens on environmental and social and emotional learning (Lohr et al., 2022; Merritt et al., 2021; Moore et al., 2012, 2015). Our argument for gardens as spaces of purposeful play is based on findings from these survey-based studies as well as an ongoing quasi-experimental, mixed-methods study (Marston et al., 2021/2023).

We introduce foundational theories and related literature followed by examples of what each theory looks like in practice in the context of purposeful play in the garden. These examples are drawn from past and current experiences with children and teachers in the district. We highlight innovative, evidence-based practices that enhance school-to-family connections and integrate mathematical and scientific thinking in the authentic and therapeutic setting of the garden. Here children can connect with both human and non-human others and engage in purposeful play from collaborative to sensory activities. Finally, we offer recommendations and considerations for policy makers and practitioners to incorporate purposeful play through comprehensive garden programs that promote healthy learning and development for students of all ages.

Self-determination theory and learning gardens

According to the literature school gardens foster children's natural sense of curiosity and wonder (Pollin & Retzlaff-Furst, 2021) and provide a unique space for teachers and students to engage in discovery learning around academic content in a real-world setting (D. R. Williams et al., 2018). The benefits of a comprehensive garden program are not limited to academic gains. Gardens provide a loosely constrained environment where children can satisfy the basic psychological needs of autonomy, competence, and relatedness and experience well-being (Deci & Ryan, 2000; Pollin & Retzlaff-Furst, 2021; Reeve et al., 2004, 2018; Ryan & Deci, 2020; Skinner et al., 2011).

Autonomy in learning gardens

Self-determination theory (SDT), introduced by Deci and Ryan (1985), posits that human beings of all ages possess an innate desire to work toward well-being through the satisfaction of 3 basic psychological needs: autonomy, competence, and relatedness. According to Deci and Ryan (1985) autonomy is defined as "experiencing one's behavior as emanating from or endorsed by the self rather than being initiated by forces or events that feel alien or with which they do not identify." Autonomy-supportive behaviors and activities include those where the individual feels as though they are engaging in an activity important, interesting and meaningful to them. Autonomy is central to experiencing intrinsic motivation, where engaging in the activity itself is rewarding and motivating. For young children, play allows them to experience this sense of autonomy and intrinsic motivation. Purposeful play in school gardens supports children's need for autonomy.

Competence in learning gardens

Competence is defined by Deci (1975, p. 55) as "one's ability or capacity to deal effectively with his surroundings." Young children use play to try new skills and develop competencies. Feeling competent in one's actions also helps satisfy the need for autonomy. In gardens, children regularly explore and take part in problem solving with visible and tangible results. Children can use the creative energy of play and exploration to find solutions to real problems resulting in a sense of competence.

Relatedness in learning gardens

Relatedness pertains to the need to connect with others and to form positive relationships with them (Baumeister & Leary, 1995; Deci & Ryan, 1991; Ryan & Powelson, 1991). Play is central to the satisfaction of the need for relatedness as young children engage in play with others or participate in pretend play where they take on the role of others. When children experience satisfaction through autonomy, competence, and relatedness they enter a state of well-being that is optimal for learning and maintaining attention and motivation.

Well-being in learning gardens

Activities in the garden can meet the basic psychological needs of children in differing ways as it is a nontraditional environment that provides greater opportunities than traditional classroom activities for autonomy and competence, and it supports feelings of relatedness among peers, teachers, the school, and the wider community.

Studies conducted with children in 6th grade showed students who were highly engaged in gardening activities also showed high engagement in school and high perceptions of autonomy, competence, and relatedness (Skinner et al., 2011) and increased achievement in science when combined with culturally sustaining pedagogies (D. R. Williams et al., 2018). Culturally sustaining pedagogy "seeks to perpetuate and foster—to sustain—linguistic, literate, and cultural pluralism as part of schooling for positive social transformation" (Alim & Paris, 2017, p. 1). Culturally sustaining pedagogies support the continued connections of students' cultures and home lives with experiences in school. Students are

encouraged to bring their own funds of knowledge to the classroom where new learning is added in ways that support their individual identity development rather than viewing students from marginalized populations as deficient in classroom knowledge (López, 2017; Lee, 2017; López, 2019; Wakefield et al., 2021). D. R. Williams et al. (2018) suggest that gardens have a unique ability to foster autonomy, competence, and relatedness among minoritized students as gardens provide greater opportunities for culturally relevant learning to wide ranges of students. Cutter-Mackenzie (2009) examined the process of one school redesigning their school garden into a multicultural garden for students aged 6–12 who were second language learners in Australia. As part of the garden program overhaul, family and community members were invited to work as garden buddies with students to share and exchange cultural knowledge while working in the gardens. Relationships among garden buddies, teachers, and students were strengthened and cultural sensitivity increased through the sharing of cultural knowledge. Working on real problems where cultural knowledge can be applied generates a sense of belonging and supports the needs for autonomy and competence (D. R. Williams et al., 2018). Inviting students to get involved in gardens at an early age would likely strengthen engagement as they continue to grow and learn in the gardens.

Purposeful play using SDT in learning gardens in practice

One example of an activity that can be done in the learning garden, employing a similar approach of combining culturally sustaining pedagogies with SDT as discussed by D. R. Williams et al. (2018), is building *chinampas*. A chinampa is a floating garden originally created in Tenochtitlán, what is now the historic center of Mexico City, the capital of the Aztec empire. Because of inadequate rainfall and poor soil fertility, the Aztecs created chinampas on Lake Texcoco's shallows. The chinampas are the antecedents of present day aquaponic systems where water from fish tanks is cycled through tubing for biofiltration to both fertilize adjacent growing beds and filter the water that is returned to the fish tanks. Moving between what they learn about chinampas from a short video entitled "Aztec Ingenuity" that discusses how the early chinampas of the Aztecs are precursors to the aquaponic system at their school, students as young as second grade learn to build replicas of chinampas. This activity helps them understand Aztec agriculture, science and engineering, and the chinampas' influence on present day hydro-agriculture as well as about Aztec culture. When doing this lesson with second graders as part of a learning garden program in Tucson, Arizona many students were excited to see themselves and their own cultural heritage reflected in the activity. Learning how the Aztec people used scientific principles and creative thinking to generate solutions to their environmental limitations resulted in a sense of relatedness for many of the Latine students increasing their enthusiasm and motivation for the lesson. Cultural connections like those in this lesson also increase students' sense of autonomy as they see their own cultural values present in the activity and respected in present day science. The structure of the lesson provides appropriate developmental challenges and supports students' feelings of competency as they play with various materials and create their own chinampas. Combining culturally sustaining pedagogies with SDT along with activities that use children's creativity results in purposeful play that fosters meaningful and culturally relevant learning.

Benefits of green spaces on emotions, cognitive functioning, and creativity

Previous research also shows that playing in gardens supports emotional well-being in school. Pollin and Retzlaff-Furst (2021) found that students reported experiencing positive emotions such as happiness, pride, and surprise/wonder more in gardens than in the classroom. They also found that students perceived experiencing negative emotions such as disgust, fear, and anxiety more in classroom-based learning as compared to garden-based learning. Similarly, Holmes et al. (2020) found that 5th graders who spent an hour per week in gardens as part of the Delta Edible Agriculture Teaching Students (EATS) program reported positive self-perceptions. The students strongly agreed with statements related to strong leadership and problem-solving skills and reported feeling as though they could make a difference in the future. Qualitative data supported student experiences of joy, confidence, leadership, and effective teamwork while in the gardens. Part of the appeal of play in early childhood is that it is fun and engaging. Ohly et al. (2016) conducted a review of research related to the impacts of gardens on student well-being and found several qualitative studies that included quotes from students expressing feelings of joy, care, empathy, and compassion while working in the gardens. Some students viewed the garden as a place where they could be fully present and referred to gardens as "sanctuaries" that helped them decrease unpleasant emotions like stress. Students were also better able to regulate their emotions and express themselves while in the gardens.

In our own work we have also found that the gardens provide a unique opportunity to cultivate joy in exploring and learning. Within the recent context of the COVID-19 pandemic, prioritizing time and space where teachers and students can feel joy in learning is crucial for reengaging them and protecting teachers and students from burnout (Marston et al., 2021/2023). A 2017 program evaluation in the same Tucson school district conducted on the impact of gardens on 3rd, 4th, 5th grade and high school students and teachers' emotional or general well-being had similar findings (Korchmaros & Haverly, 2017). Sixty-three percent of the teacher group reported their time in the garden reduced feelings of stress either "quite a bit" or "very much" with 54% reporting that the garden improved their quality of life, again, either "quite a bit" or "very much." For the elementary school students, 91% reported that the gardens had a positive effect on their emotional well-being and for high school students it was 100%. The generation of positive affect and stress reduction cultivated through experiences in learning gardens is particularly important as teachers and students return to school following the COVID-19 quarantine. During COVID-19, Kush et al. (2022) found that teachers experienced greater levels of anxiety and distress when compared to other professionals, including healthcare workers. Providing programs and spaces such as school gardens that foster positive emotions and protect teachers' mental health can potentially improve teacher retention as well as academic outcomes for students. In our current NSF research on resilience and school gardens, one teacher verbalized most succinctly what most told us in other words: "The garden gives kids a sense of purpose. They feel joy, they're happy, and that's a good thing for learning" (Marston et al., 2021/2023).

For young children, many of these positive emotional experiences and positive social interactions are most effectively facilitated through play (LeFrancois, 2020; Parten, 1932, 1933). Like adults, children are more likely to do things that generate a positive emotional experience and avoid those that result in unpleasant emotions. Inviting young children into the gardens to spark their own creativity and curiosity, to connect with the natural world

and each other is a seamless way to support purposeful play, as well as learning and development in early childhood. Combined with the satisfaction of basic psychological needs, these positive emotional experiences rooted in learning gardens can increase motivation and attention among young children, leading to improved learning outcomes.

Research from cognitive psychology has shown the cognitive and affective benefits of spending time in nature and in green spaces. Green spaces such as gardens provide the brain with an opportunity to restore and improve cognitive function (Berman et al., 2008; Bratman et al., 2015) leading to improved learning experiences in the classroom. Bratman et al. (2015) found that negative emotions such as anxiety, rumination, and negative affect decreased among participants after taking a nature walk. These negative emotions decreased significantly more than the group who took walks in busier, more urban settings. Additionally, the group who went on a nature walk showed increases in their verbal working memory when compared to their performance before going on the walk. Verbal working memory is used to store important information temporarily so that we can apply it to complex tasks. In school, verbal working memory is what learners use to keep track of multi-step tasks like math problems or directions (Kulman, 2015). Bratman et al. (2015) were able to show the restorative benefits of spending time in natural, green spaces. Learning gardens have the potential to provide children with the same kind of affective and cognitive benefits that extend their abilities to engage in cognitive classroom tasks.

Green spaces like gardens are also places where children's brains can enter a stage of the creative process known as "incubation" (K. J. H. Williams et al., 2018). Incubation is a period of subconscious thought where children are no longer directly engaged in a task but processing related information in their subconscious minds. Incubation is critical for creativity and problem solving as it allows the brain to associate information in novel ways even when children aren't directly focused on the task (K. J. H. Williams et al., 2018). Incubation typically precedes the "insight" phase of creative thinking where children often experience the "aha" moment (Santrock, 2018). Creative thinking is undoubtedly important for problem solving in and out of the classroom. For young children, play has been shown to increase creativity and academic performance (Begehhto & Kaufman, 2014). Gardens offer a space that allows children to step away from cognitively demanding tasks and enter incubation while also restoring their attention and decreasing negative emotions.

Purposeful play in learning gardens benefiting emotions and cognition in practice

Learning gardens house a variety of plants and animals that can foster cognitive and social and emotional development as well as encourage creative thinking. Young children in schools with chicken coops are often fascinated by the animals. They want to touch and hold them and get to know their personalities. In one Tucson school garden, once children were taught how to handle the chickens following CDC best practices (Centers for Disease Control and Prevention, 2022), they talked about how the chickens "are fluffy and warm and funny." Many children said that the chickens were their favorite part of being in the garden because clutching them helped them feel relaxed and happy. Interacting with the plants and animals in the gardens has a therapeutic effect for many children that supports positive emotional experiences like those adults experienced on the nature walks (Bratman et al., 2015) and by the students in the gardens studied by Pollin and Retzlaff-Furst (2021). The positive emotions experienced in the gardens have the potential to create positive

associations with learning and school in general, which can improve motivation and learning outcomes.

A related example of how children utilize creativity and problem-solving skills in the gardens reflects how children learn the hard boundaries within the environment the chickens cannot cross. While it's fun to let a chicken or two loose for a bit to peck the earth and look for bugs, eventually the chickens must be returned to the coop to protect them from predators. Children use their creative problem-solving skills to learn how best to round them up and return them to the coop. Children enjoy working together to develop strategies to "trap" the chickens by keeping them within the perimeter of the group. The rustling of chickens is a playful game that also helps develop collaborative decision making and communication skills.

In the examples above, children have an opportunity to step away from the more structured, often cognitively taxing, learning of the classroom and engage in purposeful play in the garden. The garden serves as a place where children can restore cognitive energy and continue to process classroom learning on a subconscious level while engaging in complementary tasks that continue to support their creativity and cognitive development.

Identity development in learning gardens for early childhood

A school garden is an ideal location for children to engage in purposeful play that will not only foster well-being and cognitive development, but also support identity development in early childhood. According to Erik Erikson's Psychosocial Theory of Identity Development, people pass through various stages of identity development across their lifespan. Each stage is defined by an archetypal struggle or "psychosocial crisis" that we are driven to resolve. The resolution of each of these psychosocial crises results in the development of certain characteristics and virtues. During the early childhood years children are in the Initiative vs. Guilt (ages 3–5) or the Industry vs. Inferiority (ages 5–13) stage of identity development (Durwin & Reese-Weber, 2020). For children in the Initiative vs. Guilt stage of development they are very focused on play and initiating play to determine if it's acceptable for them to move and act in the world. Family members, caregivers, and early childhood teachers provide them with feedback as to whether they can indeed initiate action in the world or if they should not. Children who are encouraged to explore, use tools, create, develop initiative and a sense of purpose. Children who are discouraged from initiating, moving, and doing develop a sense of guilt around enacting their own behavioral desires. Children in the Industry vs. Inferiority stage of identity development are primarily concerned with engaging in meaningful activities. These industrious activities allow them to develop a sense of confidence in their abilities. Gardens foster identity development for children in both stages of development. In the gardens children learn to use tools, can create art, are encouraged to explore, observe and problem solve, all of which contribute to a child's sense of initiative and industry (Durwin & Reese-Weber, 2020; Pollin & Retzlaff-Furst, 2021). In their review of qualitative studies of the impact of gardens on well-being, Ohly et al. (2016) found numerous examples of how students gained confidence through working in the gardens. Students in the studies reviewed experienced pride and satisfaction through caring for plants in the gardens and contributing to their growth until it was time to harvest them. Raising plants and animals in the gardens provides children with direct, visible evidence of their ability to use their own skills to generate and sustain life in the gardens.

Identity development through purposeful play in learning gardens in practice

One way to support the development of initiative and industry among children is using the garden as a form of structured recess. During this time children as young as pre-school age can be taught to fill water cans and water plants, feed the chickens and fish, rake the grounds, or turn compost piles (with child-sized tools). Children participating in these kinds of chores often see them as play providing fun and engaging way to try new skills. Teachers can guide children as they explore ways to use the new tools to ensure safety as they discover how to use them effectively. Teachers can provide reinforcement through observation to ensure the students feel confident and efficacious in their contributions. Over the course of a few weeks, students improve their practices and develop mastery over the garden chores. Many students even learn to recognize opportunities for efficiencies in performing the tasks. Encouraging them to try new ways to complete the tasks reinforces their sense of purpose and confidence. When it's time for children to rotate into a different chore, outgoing children can train incoming ones such that autonomy is realized along with the promotion of initiative and a sense of industry.

Conclusion and recommendations

Play is an important conduit for learning in the early childhood years. Experiences with play support motivation, well-being, cognitive and identity development, creativity, and problem-solving skills. Young children use play to discover and practice new skills to support their sense of autonomous selfhood and build competence. Play also gives young children opportunities to connect with peers, teachers, and their own cultural values, all of which satisfy the need for relatedness. Children can engage in purposeful play that supports their developing sense of initiative and industry. Play provides unique, safe opportunities for children to try new skills and strategies in novel ways, supporting their use of creative thinking and problem-solving. Additionally, play can provide space and time for children to process more complex tasks and restore emotional and cognitive energies. Providing young children with ample opportunities to explore and learn through play is vital for optimal school experiences. Non-traditional spaces such as learning gardens are ideal for children to engage in purposeful play that supports their basic psychological needs as well as cognitive and identity development. Gardens offer the additional emotional and cognitive benefits of being outdoors in green spaces. The purposeful play children engage in while in the gardens provides a break from more structured classroom tasks while simultaneously supporting meaningful learning and optimal development.

The importance of play as a significant vehicle for learning should be emphasized with teachers and policy makers. Abundant evidence shows that providing time and space for play supports the development, well-being, and optimal learning conditions for children in the early childhood years. Investing resources in spaces such as gardens that support purposeful play, learning, and development should be prioritized. When planning and maintaining learning gardens it is important to consider how and where stable funding can be secured. According to an Occidental College survey of schools in Los Angeles Unified School District, interest in gardens among teachers, administrators, and school personnel was high in schools with and without gardens, but concerns over space, funding, and lack of knowledge proved to be common barriers to starting and maintaining successful

school garden programs (Azuma et al., 2001). Teachers reported feeling overloaded by regular, standards-based curriculum despite their desire to incorporate the garden in a more consistent way. Policy makers can provide aid and support through funding programs like gardens that utilize non-traditional settings for purposeful play and learning. School gardens offer countless benefits for children such as increased well-being, positive emotional experiences, increased cognitive development, and they provide opportunities for identity development and development of creative problem-solving skills. Learning gardens can serve as a central hub for learning and development through play as well as family and community connections.

Teacher preparation programs might also consider incorporating garden-based teaching skills in various subject area methods courses and practicum experiences. Helping preservice teachers view the garden as an extension of the classroom rather than a separate space or a reward for good behavior could help new teachers enter the classroom with a robust understanding of how best to utilize gardens to support academic and social-emotional development. Gardens offer a flexible environment where learning through play is self-determined and purposeful. Children can practice new skills in a living environment that provides real time feedback helping to shape their growing competencies. They can see the results of their newly acquired skills and their abilities to do and act in an impactful way. These experiences naturally support well-being and foster continued development both in and outside of the classroom. Integrating such experiences in teacher preparation programs ensures that new teachers are equipped with the necessary skills and tools to utilize gardens to their fullest potential.

For practitioners, encouraging teachers, counselors, and administrators to view garden spaces as a central place of learning is crucial. As Austin (2022) points out, the presence of key personnel who maintain the garden and encourage others in the school and community to get involved are critical to successful school garden programs. Teachers will need support in integrating the garden with classroom learning and adapting lessons for the garden space to allow children to learn through natural curiosity and play. Involvement and support from school leadership is necessary for successful garden programs. Administrators can assist in fundraising efforts and ensure that children and teachers are provided with adequate time to plan for and utilize play-based learning in the gardens (Austin, 2022). Parents and community members can also contribute valuable efforts in maintaining a robust garden program. Inviting the community to participate in garden activities further supports the use and health of the garden as well as home and school connections.

The benefits of learning through purposeful play in places like learning gardens are many and should be a focus of policy makers and practitioners. Providing access to such spaces beginning in early childhood and continuing through K-12 grades has the potential to optimize the educational experience for students of all ages. Play is an essential part of learning, particularly in the early childhood years. Ensuring access to spaces and places that foster a natural sense of curiosity and invoke purposeful play should not be viewed as antithetical to academic learning but should instead be seen as a way to invest in long-term academic success and the well-being of students. To eliminate or lessen time spent learning through play is to disregard the developmental needs of early childhood learners and withhold opportunities for optimal cognitive and identity development that will support their academic achievement and long-term well-being.

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Additional Resources

1. **The Sonoran Desert School Gardeners' Almanac.** https://schoolgardens.arizona.edu/almanac
   Developed by The University of Arizona's School Garden Workshop, The School Garden Almanac is an annual publication that harnesses the knowledge and traditions of the Tucson community to inform teaching and learning in school gardens in the Sonoran Desert eco-region. The almanac can be downloaded using the link. In addition to the virtual almanac, we have also included a video about the almanac that can be viewed here: https://www.youtube.com/watch?v=lDMSqOJVPBg

2. **School Garden Resources by Theme and Grade Level.** https://schoolgardens.arizona.edu/curriculum/curriculum/theme-grade-level
   The University of Arizona School Garden Workshop website provides lesson plans by theme and grade level. School Garden Lesson Plans for Early Childhood have been created by early childhood educators in the Tucson Unified School District and are available as PDF downloads free of charge. These lesson plans draw from a range of topics and can easily be adapted for different ecoregions. Click the link to find the collection of these lesson plans.

3. **The School Gardeners' Southwest Desert Almanac Conference.** https://www.schoolgardenalmanac.org/home
   The Southwest Desert School Gardeners' Almanac Conference website contains garden-based teaching materials including cases/lesson guides, white papers, and other publications related to fostering garden-based science teaching in elementary schools. NSF DRK-12 sponsored the event that drew dozens of educators from around the southwest ecoregion to demonstrate best practices and learn from each other.