Supporting STEM in Early Childhood Education

Jennifer Buchter, M.Ed., MSW, LSW
Maryssa Kucskar, M.Ed.
Conrad Oh-Young, Ph.D.
Jenna Weglarz-Ward, Ph.D.
Jeff Gelfer, Ph.D.

Research has demonstrated that the drive to explore, interact and observe in human beings begins in early childhood, long before middle and high school, and even before elementary school. At the same time, the nation's economy is moving toward technologically based industries, creating growth in demand for workers proficient in science, technology, engineering and mathematics (STEM). The question is, how can Nevada cultivate a generation of adults that is prepared to thrive in the 21st century economy? The answer is, begin recruiting and training them to serve in Early Childhood Education (ECE) capacities. Despite overwhelming evidence in support of this approach, high-quality STEM programming has not yet been incorporated into ECE.

Nevada Facts & Statistics

- By 2018, STEM-related jobs are projected to increase to nearly 50,000, a 25 percent increase from 2008 levels.
- A report by the Brookings Metropolitan Policy Program in partnership with the University of Nevada, Las Vegas, *Cracking the Code on STEM, a People Strategy for Nevada's Economy*, found that the K-12 education system is inadequate to address STEM educational outcomes.

U.S. Facts & Statistics

- During the first decade of the new millennium, the demand for STEM-related careers increased by 14 percent nationally.
- Advancing American students from the middle to the top tiers in mathematics and science is a federal educational priority.
- The National Science and Technology Council, along with the Committee on STEM Education, the National Association for the Education of Young Children, and the Next Generation Science Standards concur the exposure to STEM during early childhood is critical to establishing an optimal educational trajectory.

Recent Actions in Nevada

- In 2013, Nevada developed an economic diversification plan entitled, *Moving Nevada Forward: A Plan for Excellence in Economic Development*. This plan explicitly called for increasing STEM-related jobs so the state is positioned to participate in that high-growth facet of the economy.
- In the 2015 legislative session, $882 million was committed to education, including STEM instruction.
- SB 345 created an advisory council to address barriers within our state's educational system, with the intent of improving STEM outcomes in K-12 and postsecondary institutions.

Considerations for Future Actions

Producing STEM programming in ECE is both uniformly supported by the education community and straightforward to execute. Recommended measures include:

- Require high-quality teacher preparation and professional development for ECE educators in STEM methodologies.
- Utilize STEM curriculum that aligns with Next Generation Science Standards (NGSS) and National Association for the Education of Young Children (NAEYC) recommended practices.
- Incorporate NGSS science standards as part of state early childhood standards and report these measures.
- Work with the Advisory Council on STEM initiatives within the Department of Education to include early childhood as a component of Nevada's statewide plan.
- Utilize existing facilities outside of formal school settings to bring STEM content to students, especially those in low-income or high-need schools (ie.; discounts for young

children to museums, advertising state parks and recreation areas, etc).

Statewide Benefits of Future Action

- As tremendous growth occurred between 2000-2010 within sectors such as biomedical engineering (62 percent), systems software development (32 percent) and medical sciences (36 percent), Nevada has been missing out on opportunities to grow economically while diversifying its economy.
- Addressing this issue by broadening access to high quality STEM curriculum is also likely to improve the state's overall educational outcomes, removing an additional obstacle to recruiting new businesses.
- Professional development opportunities for educators also serve to connect teachers and families to public- and private-sector professionals and community resources.

Implications of Maintaining Status Quo

- While there has been some growth in technology-related jobs in Nevada, that growth lags far behind the national average. Barring intervening variables such as early adoption of STEM curriculum, this trend is unlikely to change significantly.
- AB 449, which enjoyed broad bipartisan support, was designed to restructure and re-energize economic development in Nevada. This goal remains a focus item at the state level, but the lack of STEM-qualified employees inhibits its progress.
- Last decade's recession demonstrated Nevada's susceptibility to economic downturns, especially those affecting tourism. While the leisure and hospitality industry remains critical to our state's economic well-being, continued over-reliance upon that sector fosters continued vulnerability at the local and state levels.

Introduction

The early childhood years, birth to age 5, have long been accepted as the most critical point in neurological or brain development (National Scientific Council on the Developing Child, 2007). Children are born curious, naturally exploring and interacting with their world (Piaget, 1952; Elkind,1976). During the earliest years, infants and toddlers develop 700 neural connections every second. These biologically driven neurological processes and natural curiosity of how the world works make early childhood an optimal time to introduce children to scientific inquiry. This sensitive period of development must be utilized to start children on the right path to be successful in STEM (science, technology, engineering, and math) and other content areas because, once these neurological pathways are developed, they go through a pruning process in which synapses that are not used are eliminated (National Scientific Council on the Developing Child, 2007; Neurons to Neighborhoods, 2000: Shonkhoff, 2000). This paper will examine current state policies and educational practices being implemented as they relate to STEM's nexus with early childhood development. Recommended practices from early childhood professional organizations will be examined in addition to research on STEM education in early childhood. Lastly, a review of what other states are implementing will be provided.

State of Nevada's Need for STEM

Nevada has recognized the critical need for highly qualified STEM professionals in supporting and diversifying Nevada's economy. In 2012, Nevada adopted an economic diversification plan, *Moving Nevada Forward: A Plan for Excellence in Economic Development* (Nevada Board of Economic Development, 2012), which focused on increasing technology jobs in the state. While there has been some initial growth in technology-related jobs, current systems in Nevada have not be able to keep up with demand, as there still are not enough qualified professionals to meet the projected demand. This trend is exacerbated by projections that STEM jobs in Nevada will increase to 49,460 jobs by 2018, up from 37,220 in 2008 (Nevada Board of Economic Development, 2012). Because Nevada continues to struggle in producing a highly trained and highly qualified STEM workforce, Nevadans are losing out on economic opportunities (i.e., higher-paying jobs). Furthermore, this has the potential to negatively impact our state's economic stability. Fortunately, this has not gone unnoticed by the Governor's office as he addressed these concerns in the State of the State Address, and included $882 million in education funding to include and expand on STEM education, recognizing and committing education systems to the need for more

STEM workers (Nevada Board of Economic Development, 2012).

These issues are not isolated to Nevada and can be found nationwide. The projected increase in need for STEM careers nationally from 2000-2010 is as follows: 14 percent in overall STEM fields, 16 percent in mathematics, 22 percent in computer systems analysis, 32 percent in systems software development, 36 percent in medical sciences, and 62 percent in biomedical engineering. The federal educational priority has been to advance American students from the middle to the top tiers in math and science (U.S. Department of Education, 2016).

In 2013, Nevada Senate Bill 345 was approved, taking effect July 1, 2013. This bill created an Advisory Council on Science, Technology, Engineering, and Math within the Department of Education. This council is to report their recommendations for curriculum and instruction in STEM in public schools to the State Board of Education, the Governor, and the Legislature. Appointed members include the Superintendent of Public Instruction, the Chancellor of the Nevada System of Higher Education, the Executive Director of the Office of Economic Development, the Director of the Department of Employment, Training, and Rehabilitation, and 13 appointed members that include classroom teachers in STEM content areas as well as school administrators. According to the Nevada STEM Coalition website, the target audience is K-12, higher education, and workforce development. At this juncture, early childhood has not been incorporated. This Council is tasked with creating a strategic plan to develop STEM educational resources to serve as a foundation to support the workforce and higher education, to identify students in the state who excel in STEM, and identify and award no more than 15 schools with exemplary STEM outcomes. In addition to this recognition, this council is also tasked with conducting a survey of STEM educational programs in Nevada and in other states to identify recommendations that could be implemented in Nevada.

In 2015 the Nevada legislature passed the Read by Third Grade Initiative, Senate Bill 391. This initiative will begin implementation in 2017 to promote effective literacy supports and instruction for students in kindergarten through third grade. STEM inquiry based curriculum can help support this initiative through increasing literacy and STEM outcomes, including children who are English language learners or at-risk for academic difficulties

Waiting Until Kindergarten is Too Late

A report by Brookings Metropolitan Policy Program in partnership with University of Nevada, Las Vegas, *Cracking the Code on STEM, A People Strategy for Nevada's Economy*, identified the crisis in Nevada's early childhood preschool-12th grade education system to adequately address STEM educational outcomes (Lee, et al., 2014). Recommendations from this report include developing guidelines for STEM education programs, creating a preschool-12th grade competitive grant program, incorporating computer science in preschool-12th grade education, encouraging student excitement about STEM and STEM careers, and increasing STEM outreach efforts to all students.

These recommendations align with Next Generation Science Standards (NGSS) and National Association for the Education of Young Children (NAEYC) recommendations, as well as federal initiatives to include preschool in STEM education reforms (Committee on STEM Education and National Science and Technology Council, 2013). Early childhood is a critical time to begin quality STEM education, as research has suggested that this period of development to be optimal for setting children on a STEM trajectory, increasing the diversity of students who are interested in STEM and competent to be successful in STEM fields (Eshach & Fried, 2005; French, 2004; Gelman & Brenneman, 2004; Inan, 2007; Watters, Diezmann, Grieshaber, & Davis, 2000). It is clear that in order for the state to succeed in diversifying the economy by increasing the number and quality of STEM professionals, the current crisis in Nevada's preschool-12th grade education system will need to be addressed (Lee et al., 2014). Simply put: waiting until kindergarten may be too late (Lee et al., 2014).

Achievement Gap

It is critical that effective inquiry-based scientific opportunities in STEM areas be incorporated to address the achievement gap, increase outcomes in STEM areas, increase the number of students and professionals entering STEM fields, and increase the representation of minorities, women, and low-income students in STEM majors and fields. The achievement gap in STEM continues to persist across grade, race/ethnicity, socioeconomic status, and gender (Lee, 2005; National Science Foundation, 2001, 2002, 2015; O'Sullivan, Lauko, Grigg, Qian, & Zhang, 2003). These discrepancies are found across virtually every study (Lee, 2005) and are prevalent from the very beginning of a student's school experience. Studies have suggested the strongest predictor of people entering the science field is early interest and difficulties in science in school acts as a deterrent for students considering the pursuit of science in higher education or in their careers (Mbamalu, 2001). Addressing these difficulties in the early years and ensuring all children have access to quality STEM instruction can begin to address these discrepancies.

While all children need high quality science experiences, at-risk children experience disproportionately negative outcomes in all domains, with the greatest impact being in science (Greenfield et al., 2009). These children are more likely to be dual-language learners and less likely to have opportunities to develop science content knowledge (Sarama & Clements, 2009). In addition to these issues, research suggests that teachers in schools of low socioeconomic status (SES) student populations rely on memorization and rote practice as teaching methods rather than reasoning and problem solving (National Research Council, 2009). Teachers in higher SES programs tended to emphasize conceptual tasks, problem-solving and exploration (National Research Council, 2009; Stipeck & Byler, 1997).

Current perceptions of science are not realistic. Science and scientists need to be representative of actual practices and young children need exposure to the work of scientists (Duschl, Schweingruber, & Shouse, 2007). Findings from the literature suggest a prevalence in the belief that, while science is something that anyone can participate in, individuals need to be born with some type of inherent characteristic in order to excel at it (Archer et al., 2010; Carlone, 2004). It appears that this belief carries over into later years, at which point teachers must address content-related gaps as well as student attitudes as they pertain to learning science (Morgan et al., 2015). For example, students interviewed describe an identity of an individual who excels in physics as, "someone who is 'naturally' smart, has 'raw talent', and is male" (Carlone, 2004 p. 405).

Recommended Practices

Professional organizations such as the National Science Teachers Association (NSTA), NGSS, and NAEYC have acknowledged that it is essential to begin scientific inquiry in the earliest years (Eshach & Fried, 2005; French, 2004; Gelman & Brenneman, 2004; Inan, 2007; Watters, Diezmann, Grieshaber, & Davis, 2000). This is a significant issue as research has suggested that if educators wait until kindergarten, not only will they have lost the most critical years, but it may be too late for many children (Elkind, 1976; Piaget, 1952). For example, consider that currently 40 percent of US children are not ready to enter kindergarten (Hair, Halle, Terry-Humen, Lavelle, Calkin, 2006). By 4th grade, only 34 percent of students are at or above proficiency in science (U.S. Department of Education, 2011), and 40 percent are at or above proficiency in math (National Center for Educational Statistics, 2012) on the National Assessment of Educational Progress (NAEP). These data suggest current educational practices are not giving children the support they need in the early years so they can be successful in school, especially in the STEM content areas. The NSTA recently issued a position statement that was endorsed by NAEYC that provides a framework for how STEM in early childhood classrooms can set our youngest students on a trajectory to be successful in K-12 STEM.

Scientific Inquiry Approach

The process of scientific inquiry in STEM areas should include children engaging in active exploration and participation in the scientific process through collecting data, coming up with questions to investigate, and testing scientific beliefs (Duschl, Schweingruber, & Shouse, 2007; Zeynep Inan & Inan, 2015). These processes include children participating in scientific inquiry through hands-on experiences, engaging with peers and adults, and using authentic tools of science. Science experiences for young learners should include hands-on experiences, inquiry based, and be driven by their interests (Inan, 2007; NAEYC & NCATE, 2001; NRC, 2001). This process encourages the youngest learners to see themselves as scientists and as consumers of science. The focus on developing and testing theories rather than arriving at the accurate scientific explanation is instrumental in supporting curiosity, interests, and engaging in further exploration (NAEYC & NCATE, 2001; Duschl, Schweingruber, & Shouse, 2007).

Inquiry-based approaches have been shown to support student excitement and engagement, connect previous knowledge with new knowledge, promote cooperative learning, retention of material, and higher order thinking skills (Duran et al., 2009; Eshach & Fried, 2005). While the philosophies of inquiry-based instruction, constructivism, and hands-on learning are well established in early childhood literature, their application to STEM areas are relatively new. Research suggests that, while these processes are implemented in other content areas, teachers do not implement these methods in STEM instruction, instead relying on more traditional methods (Gilbert, 2009). These traditional methods of instruction such as memorization and rote practice have been found to be ineffective in teaching science to young children (Fleer, 2009; Wolfinger, 2000; Zoldosova & Prokop, 2006). This lack of quality STEM instruction impacts STEM education throughout a child's education, including middle and high school (Mullis & Jenkins, 1988).

Despite recognizing this as the optimal time for intervention, research suggests that very little STEM instruction is occurring in early childhood classrooms. Teachers spend little time in science instruction and do not spend significant amounts of time in science-related areas of the classroom (Nayfeld, Brenneman & Gelman, 2011; Tu, 2006). Currently, there is an emphasis on language and literacy, with relatively little math in preschool classrooms. A study examining how much time was spent in STEM found that just 58 seconds of a 360-minute day—less than 0.3 percent of the students' time—was spent on math. Science and exploring engineering were rarely part of the curriculum (Farran, Lipsey, Watson, & Hurley, 2007). Teacher engagement with children is a critical component of supporting STEM inquiry. In addition to preparing the environment, they support and extend children's engagement by asking questions, providing language, and connecting previous experiences to current experiences. When teachers engage in these practices with young children, their investigations tend to be longer, more complex, and focus on comparisons (Nayfeld, Brenneman, & Gelman, 2001; Crowley et al. 2011). The lack of emphasis and time spent in STEM in early childhood programs needs to be addressed. STEM needs to be an integral focus in both curriculum and designing the learning environment.

Educational Impacts of Early Childhood STEM

Initial outcomes and results on the impact of quality early childhood STEM instruction are promising, further supporting the need to increase the investment and commitment to inquiry-based STEM instruction for our youngest learners. In addition to the benefits of inquiry-based learning, adding quality STEM experiences supports the development of scientific concepts that children continue to build on throughout their education (Eshach & Fried, 2005; Gilbert, Osborne, & Fenshama, 1982). This allows for students to understand and learn more abstract concepts in future learning (Reynolds & Walberg, 1991). In addition to the benefits to STEM areas, science instruction supports and enhances learning language, literacy, math, and executive functioning (Kuhn & Pearsall, 2000; Kuhn & Schauble, & Garcia-Milla, 1992).

Language and Literacy

STEM in ECE has been linked to other educational benefits in addition to science, including language and literacy. Increases in vocabulary through scientific exploration exposes our youngest learners to a variety of vocabulary words directly related to what they experience in their everyday school and home lives (French, 2004; Strickland & Riley-Ayers, 2006). Exposure to rich vocabulary enhances language and vocabulary development, which is predicative of reading achievement. High quality science programs have been shown to increase receptive vocabularies for students of low socioeconomic status (French, 2004), as well as increasing overall scientific and other vocabulary (Gelman & Brennenman, 2004; Guo, Wang, Hall, Breit-Smith, A., & Busch, 2016). Engaging in science provides learners experience with text and is also associated with improved literacy (French, 2004; Gelman & Brennenman, 2004). Readiness in science has been found to be predictive of science and reading achievement in 5th grade, more so than reading readiness (Duncan, 2007; Grissmer et al., 2010).

Embedding Learning Opportunities

Play-based curriculum has been accepted in professional practices and is supported by research as effective for early learning (Bowman, 1999; Ginsburg, 2006; Katz, 2010). These practices can be directly applied to STEM and the scientific inquiry process. By focusing on concepts and skills, children are encouraged to take the lead in exploring, asking open-ended questions, reflecting, forming theories, asking follow-up questions, and exploring more to further understand or develop a new line of inquiry. Blending this approach with direct instruction research-based learning trajectories is important as it includes a developmental sequence that expands children's level of thinking related to the goal. Teachers arrange activities to support children moving along this developmental progression (Clements, 2013; Diamond, Justice, Siegler, & Snyder, 2013) These blended approaches align with NAEYC and the National Association of Early Childhood Specialists in State Departments of Education eight indicators of effective pre-K to grade three curricula.

The process of embedding learning opportunities can be described as, "addressing children's target goals during daily activities and events in a manner that expands, modifies, or is integral to the activity or event in a meaningful way" (Johnson, Rahn, & Bricker, 2015, p. 82). Opportunities for learning, or teachable moments, are usually embedded across child-directed, planned, and routine activities as recommended in the literature (Johnson et al., 2015). The purpose of embedding learning opportunities and teachable moments is to provide children with a means to learn, not only during periods of planned teacher-led instruction, but also during times when they are engaged in activities of interest to them (e.g., playing on the playground) and/or activities that are a part of their daily functional routines (e.g., washing hands, putting a jacket on, requesting water to drink) as they occur throughout the school day (Hyun & Marshall, 2010; Johnson et al., 2015). Embedding STEM-related opportunities allows learning to occur both out of context, such as a science experiment led by the teacher, and within daily classroom situations such caring for the class pet. Teachers could scaffold questions to help students for example, children could learn that fish live in water but butterflies live on land. Children could then observe fish in their classroom aquarium and butterflies in the garden around their school. This brief interaction could become a unit of study that allows children multiple opportunities to engage in science inquiry and apply STEM concepts. Not all current teachers may have been trained to embed opportunities for STEM-related instruction throughout daily classroom activities, therefore ongoing professional development is essential.

Practices to Support STEM

Previous STEM research has identified the barriers to implementing high quality STEM education in early childhood. Barriers include a lack of instructional frameworks for early educators, a lack of curriculum, curriculum not being linked to state standards, and inadequate resources for teachers (Oakes, 1990). While some progress has been made, early childhood STEM content continues to struggle to overcome these barriers. With the introduction and focus of STEM educational frameworks (NGSS, NSTA, NAEYC), incorporating STEM opportunities in ECE can make significant impacts on STEM education and other content areas such as reading and literacy, closing the discrepancy of student achievement, and increasing the number of students entering STEM fields.

High-Quality Teacher Preparation and Professional Development for Early Childhood Educators in STEM Methodologies

Teacher quality is one of the most important factors in student learning (Science and Engineering Indicators, 2014). However, preschool teachers do not know how to support STEM learning (Clements, 2013). It is critical that early childhood professionals are highly trained, qualified and competent to support young children, as the period of early childhood is crucial for supporting scientific inquiry based on developmental sensitivity, natural curiosity, and encouraging children to participate in science (Clements, 2013; Clements, Agodini, & Harris, 2013; Worth, 2010;).

While less intensive STEM focused interventions have been shown to be effective in impacting classroom instructional practices (Henrichs & Leseman, 2014), meaningful impacts in the classroom setting require more intentional and coordinated efforts (Early et al., 2007; Zaslow, 2014). Current findings from the early childhood education literature base suggest that rigorous, high quality professional development delivered to in-service teachers in early childhood settings has been demonstrated to improve the quality of science-related instruction (Piasta et al., 2014; Roehrig et al., 2011) and math-related instruction (Kermani & Aldemir, 2015; Marsicano et al., 2015; Rudd et al., 2009).

Research suggests that current professional development systems are ineffective and make little to no impact on teacher behavior or child outcomes (Bruder, Mogro-Wilson, Stayton, 2009; Farkas, Johnson, & Duffett, 2003; Guskey, 1986; Joyce & Showers, 2002; Odom, 2009; Snyder, Hemmeter, & McLaughlin, 2011). Traditional methods of professional development such as trainings, workshops, and conferences have been found to increase teachers' awareness; however, these forms of professional development are not associated with teachers' sustained use of research-based interventions (Artman-Meeker & Hemmeter, 2013; Barton, Penney, & Zeng, 2015; Odom, 2009). Despite their ineffectiveness in improving outcomes and increasing or sustaining teacher use of research based interventions, they continue to be the predominant forms of professional development; in-service outside of work (33.6 percent), on-site staff development (28.6 percent), and consultation and coaching (15.6 percent) (Odom, 2009; Snyder et al., 2011).

Alternative, research based professional development is critical. Delivery of high quality professional development has demonstrated significant improvement in student achievement for young children as measured on assessments (Brendefur et al., 2013; Kermani & Aldemir, 2015). Professional development should be ongoing, appropriate to the subject matter being taught, include opportunities for teachers to actively participate, and have some relevance to what is happening in the classroom (Garet et al., 2001).

A research-based early childhood STEM professional development should occur over time and incorporate multiple components. These components, based on a review of the literature, should include a science camp for teachers to observe activities and practices in classroom situations, see examples of different environmental arrangements, observe how to interact with children to support scientific inquiry, capitalize on teachable moments, and embed opportunities in daily routines and activities. In addition to a science camp for teachers, ongoing support for teachers would be available through a mentor. Technology can be used to support teachers by having a website so teacher can access recorded videos to review, modules to assist in understanding science concepts, and access to feedback with their mentor.

Utilize STEM curriculum that aligns with NGSS and NAEYC Recommended Practices.

Next Generation Science Standards (NGSS) are research-based standards for K-12 based on the assumption that children will arrive in kindergarten with the skills, knowledge, and dispositions that support their science achievement. With the introduction of CCSS and NGSS for K-third grade, it is important to remember early learning philosophy and research so young children are not expected to learn standards in ways that do support or enhance development. The NSTA Position Statement endorsed by the NAEYC (2014) and the NAEYC and National Association of Early Childhood Specialists in State Departments of Education's Effective Learning Standards (2002) should drive the implementation of these standards. States could include an emphasis on developmentally-appropriate practices of both content and outcomes, train teachers to implement and assess these standards that support all children's development, and provide support to early childhood programs, teachers, and families through resources and professional development to understand the standards and how to implement them to support children's learning. Reviewing these assessments or outcome measures can support data-based decision making and provide information that supports ongoing growth for students, programs, and teachers.

Technology

When used appropriately, technology has been demonstrated to be a useful tool that teachers can use to assist with facilitating instruction for young children (Boudreau & D'Entremont, 2010; Hine & Wolery, 2006; Lorah et al., 2013; Wilson, 2013). Furthermore, findings from recent studies conducted in preschool settings clearly demonstrate that technology can be used to teach young children STEM-related concepts (Schacter & Jo, 2016; Schacter et al., 2016). However, technology is not always utilized appropriately by teachers in early childhood settings (Oh-Young et al., 2015; Parette et al., 2013), perhaps because they did not receive training on how to appropriately use it for instructional purposes (Parette, Quesenberry, & Blum, 2010). Case in point, in a review of 23 early childhood teacher preparation programs in the United States., Parette et al. (2010) found that 13 out of the 23 programs did not require teachers to take a course on how to use technology in the classroom. In addition, researchers found that only two of the programs actually offered a technology course geared toward early childhood teachers (Parette et al., 2010). Once again, professional development for in-service teachers is necessary (Parette et al., 2013), especially since not all individuals who join the teaching force in the State of Nevada fulfill the requirements to obtain their teaching licenses within the state.

The American Academy of Pediatrics (2016) and the NAEYC (2012) recently published recommendations regarding the use of screen time, which includes educational applications as well as television and other screen time activities. Among these recommendations are that children two through five years of age should have no more than one hour a day of high quality screen media and that a parent or other adult should co-view with the child. In addition to cautions about utilizing too much technology and its impacts on development, NAEYC (2012) called attention to the lack of equity in access to computer technology for children in low SES programs. While more and more families have access to technology through cell phones, tablets, and computers, there remains a lack of equity and intentional integration of technology in early childhood curriculum to support educational outcomes.

What Other States Are Doing

Curriculum. Building Blocks (http://www.ubbuildingblocks.org/) is a curriculum funded through the National Science Foundation for pre-K to second grade that embeds mathematics into classroom centers using activities such as art, puzzles, block area, music and movement, and more. This supports making math relevant to their daily lives and experiences. Print, manipulatives, and computers extend and expand on children's prior math learning. This curriculum aligns with other state standards and can be used as a supplemental curriculum to assist teachers in integrating assessment into their teaching and using the results to drive instruction.

Tools of the Mind (http://toolsofthemind.org/) is a play-based curriculum, based on the works of Vygotsky and divided by preschool and kindergarten, to develop executive functioning, numeracy, and literacy. Currently, it is being used with more than 30,000 children in Head Start programs, public and private preschools, and kindergartens with promising results.

NASA Jet Propulsion Laboratory through the California Institute of Technology (http://www.jpl.nasa.gov/edu/teach/) has curriculum and activities for grades K-adult. Each activity includes a lesson plan, materials, how to set up the experiment, background and key concepts, a Ted Talk or other video support, procedures, discussion questions, options for assessment, and extensions. All the activities are aligned with NGSS and Common Core standards. These activities can be adapted for younger learners as they are inquiry based and hands-on.

Children's Museum Partnerships. Early Childhood Hands on Science (ECHOS) is a comprehensive science curriculum developed in 2010 by the Miami Science Museum through a federal Institute of Education Science (IES) grant. The lessons are arranged to lead young children toward a deeper understanding of science content using the scientific process. This curriculum is focused on children at risk for school failure, and uses teachers as facilitators of both content and the learning process. In 2014, Miami-Dade Head Start centers began professional development and family engagement through comprehensive teacher training on ECHOS curriculum, opportunities for student teachers to teach science in Head Start classrooms, and parent workshops on how to integrate science activities. Parents then have the opportunity to help teach ECHOS activities in Head Start classrooms for 36 paid hours. This program is currently in 33 classrooms, with 66 parent leaders, 30 student teachers, and 650 young children.

The Association of Children's Museums (http://www.childrensmuseums.org/) reports that 81 percent of children's museums in the United States have science exploration areas for even the youngest scientists, infants and toddlers. In addition to offering opportunities to explore directly, 40 percent run after-school programs, 60 percent develop curriculum materials, and 70 percent provide school outreach programs. Children's museums are a great resource to increase and expand scientific inquiry in early childhood programs. Many states and cities offer free or greatly reduced admission to children's museums, state museums, and other recreational activiites (state and county parks).

Children's Media. Peep and the Big Wide World, developed by WGBH Boston and 9 Story Entertainment in association with TVOntario, is an animated series for children aged 3-5 years about a newly hatched chick that explores his world. Each half-hour episode contains two segments that focus on science concepts and two live shorts of children playing and experimenting in their own world. The website provides additional games, videos, handouts, activities for families, and resources for educators to extend the show's activities in their classrooms. Using an integrated approach, the Peep developers work with early childhood teachers, public libraries, museums, community-based organizations, and families to support children's scientific inquiry.

Other popular children's media have developed resources to support early childhood STEM, including Lego and PBS (Public Broadcasting Service). In addition to television programming and toys to support STEM-based play, Lego and PBS also have resources, materials, and training for early childhood education professionals and families. Once early childhood professionals have a strong background in teaching scientific inquiry to young children (NSTA, 2014), they can utilize these resources to support developmentally-appropriate practices and rigorous scientific instruction in their classrooms and support families in applying STEM inquiry in daily activities with their child.

Early Learning Standards

Nebraska, Illinois, and Massachusetts currently have early learning standards with a STEM emphasis for children birth to 5 years old. Nevada has published its own early learning standards, the Nevada Pre-K Standards (2010) for children 4-5 years of age. These standards include math and science as separate domains in addition to other academic and developmental domains. Many states have specific STEM learning standards/guidelines for early childhood, including children birth to 3 years of age.

Massachusetts has aligned its early learning standards to the Next Generation Science Standards (2013). In addition to aligning the birth to 5 standards, there is an emphasis on early childhood at the advisory level as early childhood representatives participate on the state STEM advisory council. Nevada could expand its early learning standards by publishing standards to include children birth to 5, emphasizing embedded science opportunities and the scientific inquiry process in everyday activities, and bringing an early childhood representative to our Governor's STEM Council.

Including Families

Families play an integral role in expanding and building on their child's learning, especially in STEM, as applying the concepts and asking questions outside of the classroom further support the scientific inquiry process and STEM concepts in their everyday world. In addition to access to children's media and museums, Nevada is rich with places for families to explore with their children. There are many places in Nevada, such as the many State and National parks and monuments and museums, that are all readily available for children and families to explore and learn. Connecting families with these resources and providing information on how to support their child's learning at these places could support STEM opportunities and scientific inquiry.

Conclusion

There are many resources in Nevada that can support and enhance STEM opportunities and outcomes in early childhood. Strengthening early childhood professionals' skills through high quality professional development is critical to ensuring young children are starting off on a strong STEM trajectory and supporting other academic areas, such as language and literacy. Additional ways to support STEM could include having an early childhood representative on the STEM educational framework of Nevada including the Advisory Council on Science, Technology, Engineering, and Math within the Department of Education as a component of Nevada's statewide plan. By collaborating and utilizing existing resources and increasing early childhood professionals' skills through professional development opportunities, broadening access to high quality STEM curriculum, and connecting teachers and families to community resources, we can help support Nevada's educational outcomes as well as the economic goals of a highly qualified STEM professionals and a diverse economy.

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