IALS JOURNAL

international association of laboratory schools

Volume X, No.1

IN THIS ISSUE

Tackling Integrated STEM in Elementary Education: A Collaborative Approach
Laura Robertson, Ryan Andrew Nivens, and Alissa Lange 1

Applicable Lessons from Select Laboratory Schools Throughout the United States
Rebecca Buchanan and Sandy Frederick 14

Lab Schools: Past, Present, and Possibility
Gretchen M. Whitman 21

Toddlers Can Enjoy Food Preparation and Cooking: Connecting Food Activities with Reading Children's Books
Satomi Izumi-Taylor, Katie E. Boes, Carol Cordeau Young, and Ariel Laws 29

Retirement is Weird! A Reflection
Sandra Brown Turner 35

Unlocking Potential, Changing Lives: 2019 IALS Conference Proceedings at Texas Christian University
Marilyn Tolbert 38

LabSchoolsEurope Symposium
Christian Timo Zenke 40

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2019-2020

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The *IALS Journal* is published once a year and addresses key issues facing today's laboratory and university affiliated schools. Articles offer perspectives on educational trends and include topics such as the history and future of lab schools, innovations in curricula and programs, lab school administration, and teacher education. The journal includes articles grounded in evidence-based classroom practices, action research, and theoretically based quantitative and qualitative scholarship.

IALS Journal
Volume 10, Issue 1

CONTENTS

Letter from the Editor / **iii**

Letter from the President / **iv**

Featured Articles:

Tackling Integrated STEM in Elementary Education: A Collaborative Approach
Submitted by Laura Robertson, Ryan Andrew Nivens, and Alissa Lange / **1**

Applicable Lessons from Select Laboratory Schools Throughout the United States
Submitted by Rebecca Buchanan and Sandy Frederick / **14**

Lab Schools: Past, Present, and Possibility
Submitted by Gretchen M. Whitman / **21**

Toddlers Can Enjoy Food Preparation and Cooking: Connecting Food Activities with Reading Children's Books
Submitted by Satomi Izumi-Taylor, Katie E. Boes, Carol Cordeau Young, and Ariel Laws / **29**

Retirement is Weird! A Reflection
Submitted by Sandra Brown Turner / **35**

Unlocking Potential, Changing Lives: 2019 IALS Conference Proceedings at Texas Christian University
Submitted by Marilyn Tolbert / **38**

LabSchoolsEurope Symposium
Submitted by Christian Timo Zenke / **40**

Information for Contributors, CFP / **IBC**

LETTER FROM THE EDITOR

With many thanks to the IALS Executive Board and to our current president,

Wade Smith for his leadership, I am pleased to present the tenth volume of the *International Association of Laboratory Schools Journal*. It is without question that the valuable work of laboratory schools across the world and in the association have continued to positively impact the lives and the education of our children. In this volume and in all that follow, we aspire to provide a home for the myriad voices that are represented within our laboratory schools and to celebrate our collaborative achievements with even wider audiences.

This volume represents the combined efforts of a broad spectrum of IALS members. Laboratory school teachers, university professors, and graduate students from across the globe have contributed their academic work to this volume, and by doing so, they have asked us to consider our own stake in the greater mission of our schools. As such, I am proud to present the following contributions to this tenth volume of the *IALS Journal*.

In the featured article, "Tackling Integrated STEM in Elementary Education: A Collaborative Approach," Laura Robertson, Ryan Andrew Nivens, and Alissa Lange, STEM specialists in math, science, and early education, present timely arguments and innovations for improving the quality of science, technology, engineering, and mathematics instruction in the elementary schools. These contributors advocate for pre-service and practicing teacher training along with the practical materials and resources required for integrating effective STEM instruction into the classroom. Similarly, in "Applicable Lessons from Select Laboratory Schools Throughout the United States," Rebecca Buchanan and Sandy Frederick outline the findings of their grant-based research focused on observing collaborative university and laboratory school efforts to implement STEAM learning skills into the classroom. Both projects demonstrate the importance of forward-thinking education that recognizes new and critical shifts into teaching and learning in the 21st-century.

In "Lab Schools: Past, Present, and Possibility," Dr. Gretchen M. Whitman evaluates John Dewey's lasting philosophy for laboratory school education and argues that the "lab school of today holds promise for the new schools of the future." Whitman further contends that current laboratory school approaches may serve as positive models for education reform moving forward. Such perspectives demonstrate the purpose and power of the laboratory school as a model for ongoing and vital progressive education both in the United States and abroad.

Shifting to innovative classroom texts and approaches, scholar-researchers Satomi Izumi-Taylor, Katie E. Boes, Carol Cordeau Young, and Ariel Laws outline cooking activities that teachers and family members can implement in toddler classrooms and at home. Activities are derived from engaging children's books, and they encourage family and classroom interaction and engagement. Simple recipes, a list of children's books, and a variety of useful online resources are also included in the article for practicing teachers and interested parents. Further, senior IALS member, Sandra Brown Turner, offers an insightful, humorous and wisdom-rich reflection, titled "Retirement is Weird."

To conclude, Marilyn Tolbert, the 2019 IALS Conference Organizer, provides a summary of the memorable keynote speakers, conference sessions, and events from the "Unlocking Potential, Changing Lives" proceedings at Texas Christian University, and Christian Timo Zenke invites members to support a new project titled, "LabSchoolsEurope: Participatory Research for Democratic Education."

As contributing editor, I am honored to celebrate the work that you do in your laboratory schools, with your colleagues, and for your students each day. I hope that you enjoy this edition and that you, too, will consider honoring your outstanding teachers and laboratory schools and submitting your academic research and writing in future volumes of the *IALS Journal*.

Dedicated to research, leadership, and educational excellence,

Dr. Shannon Mortimore-Smith
Editor

LETTER FROM THE PRESIDENT

Greetings,

As you take some time to read and reflect on this issue of our *IALS Journal*, I trust the value of being an IALS member is apparent. In today's educational environment, there is a pressing need for laboratories where educational policy and practice can be scrutinized and ultimately improved. IALS is uniquely positioned to play a vital part in meeting this need.

By conducting or collaborating in research, member schools raise the standard for educational excellence throughout the world. As an IALS member, I encourage you to give consideration to how your school and you as an individual can participate in meaningful research. What you discover may impact generations of students.

Knowledge shared is knowledge gained, and you have multiple opportunities to share your findings through venues such as our Journal or at our annual convention. Making a difference is something we all want to do, and IALS makes a difference.

So contribute to knowledge, renew your membership, add to your skill set, and encourage other schools to seek membership in IALS. Be the difference that others seek to describe!

Regards,

Wade Smith
IALS President

Tackling Integrated STEM in Elementary Education: A Collaborative Approach

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Introduction

We must improve the quality of Science, Technology, Engineering, and Mathematics (STEM) education in elementary school and early childhood classrooms. In order to address this issue, we recommend improving the frequency and quality of experiential opportunities offered through teacher preparation programs. Pre-service teachers in early childhood and elementary education benefit from applied experiences, but highly involved placements typically come only at the end of their programs. Graduates may leave teacher preparation programs with varied levels of ability to teach STEM disciplines in a way that integrates skills and knowledge across the domains (i.e., Lamberg & Trzynadlowski, 2015). As a result, elementary teachers often enter service without the knowledge and skills necessary to support the inclusion of early elementary STEM lessons and units (DeCoito & Myszkal, 2018).

Once in the classroom, elementary teachers are under immense pressure to meet standards and prepare students for state tests, resulting in a variety of content covered (Polikoff, 2012). This problem is compounded when teaching standards are updated, as the STEM standards recently have been in many states under *Next Generation Science Standards* ([NGSS]; NGSS Lead States, 2013), *Common Core State Standards for Mathematics* ([CCSS]; National Governors Association, 2010), or similar revisions. Such changes are rarely paired with quality training that enables teachers to meet these new and rigorous standards, especially with a focus on integration. Our project sought to address these issues by using an innovative, collaborative approach to support the growth and learning of pre-service teachers in early childhood education (ages 5-8) and elementary education (ages 5-10) while simultaneously providing elementary teachers with materials and resources for implementing integrated STEM.

Review of Literature

Importance of STEM for Young Learners

STEM concepts are critical domains in early childhood and elementary education. Early mathematics and science skills are predictive of student performance later in elementary school and even into high school (Grissmer et al., 2010; Watts et al., 2014). In order to address the current and future challenges of our world, we will need teachers who are ready to teach STEM to young learners and who can better prepare the future workforce (McClure et al., 2017). Science, in particular, is often under-taught in the early childhood and early elementary grades (Marco-Bujosa & Levy, 2016; Poland, Colburn, & Long, 2017; Spodek & Saracho, 2014). When pre-service teachers are not involved with designing and implementing STEM lessons during the teacher preparation process, we risk continuing the cycle of marginalizing science in the early grades (Berg & Mensah, 2014; Goldston, 2005; Maulucci, 2010) which is especially concerning in current times when the culture at large expects STEM to be prominent (Freeman et al., 2014).

Challenges of Integrated STEM

One challenge of integrated STEM is lack of consensus regarding its definition. For the purposes of this project, we use the term *integrated STEM* to designate situations in which two or more STEM subject areas are integrated. Teachers and administrators cite numerous challenges to the implementation of integrated STEM in K-12 classrooms which include time for planning and implementation, preparation through pre-service education and professional development, school organization, state testing, and access to resources (Shernoff, Sinha, Bressler, & Ginsburg, 2017). These challenges have been specifically noted for implementing these types of lessons effectively with young learners (Paolucci & Wessels, 2017) and the general lack of preparedness regarding implementing integrated STEM content (Stohlmann, Moore, & Roehrig, 2012).

Bybee (2014) strongly recommends forging a connection between the NGSS and the CCSS for mathematics with an emphasis on development of these connections during pre-service teacher education; however, pre-service teachers often need support to develop an understanding of strategies that can be used to implement learning opportunities that involve authentic integration, rather than surface-level integration (Heimer & Winokur, 2015). Supporting teachers in the field to teach STEM concepts individually or in an integrated way are two possible ways to address this, but high-quality professional learning opportunities are less common and those that do exist tend to be expensive. Integrated STEM teaching for teacher preparation programs is also a challenge because it demands collaboration across domains and possibly across the notoriously siloed departments of academia. As Gardner and Tillotson (2018) wrote, "integrated STEM instruction remains ill-defined with many gaps evident in the existing research of how implementation explicitly works" (p. 1).

Pre-Service Teacher Education

Teacher education focuses on both the practical and the theoretical aspects of education. Smith and Lev-Ari (2005) reported findings that demonstrate the value of practicum in teacher preparation programs; however, science is not often linked to practicum experience in early childhood programs (Lobman, Ryan & McLaughlin, 2005). Content knowledge (CK) and pedagogical content knowledge (PCK) are both critical in effective teaching, and field experiences are conducive to developing pre-service teachers in both of these areas. Donna and Hick (2017) showed that gains in pre-service teacher CK were achieved through their efforts to implement lessons in their field placements, particularly when those lessons were modeled after best practices. Similarly, Hume and Berry (2011) found evidence that a lack of practicum experiences can be a limiting factor in pre-service teacher development of PCK.

One approach method of advancing the CK and PCK of pre-service teachers during practicum experiences is the practice of microteaching (Cinici, 2016; He & Yan, 2011). In microteaching, the pre-service teacher plans a very short lesson, often on only a single concept, and implements that lesson with a small group. Following the lesson, the pre-service teacher then receives immediate feedback, adjusts the lesson plan, and, ideally, implements the adjusted lesson plan with another small group. This has been found to be a useful way to engage pre-service teachers in experiential learning while also making a positive impact on the students that receive the lessons (Cinici, 2016; He & Yan, 2011).

Attitudes towards teaching STEM, beliefs about the value of STEM, and self-efficacy influence teaching practice (Pajares, 1992; Greenfield et al. 2009), and as Ng, Nicholas, and Williams (2010) discussed, initial beliefs can be changed throughout the course of effective teacher preparation programs. Bedel (2015) documents the importance of self-efficacy among pre-service teachers and its impact on their academic motivation, and Kazempour and Sadler (2015) found that science methods course could have a positive impact on beliefs, attitudes, and self-efficacy. Because these aspects of a pre-service teacher are important to their science teaching practice and because they are malleable, we should ensure that pre-service teacher education programs address these as part of the curriculum.

Collaborations in STEM Education

One vehicle for addressing authentic experiences, PCK and CK, and attitudes and beliefs is taking advantage of collaborations. Collaborations in education offer opportunities and experiences that can advance STEM teaching and learning by reaching across pre-service, teacher, departmental, content, and other divides to take advantage of diverse areas of expertise; however, in an extensive review of literature, Willegems, Consuegra, Struyven, and Engels (2017) found that "few studies have actively investigated the roles of other actors, such as [in-service teachers] and teacher educators" (p. 242). At the university level, faculty across departments rarely collaborate in coursework, which means that pre-service teachers (and faculty) miss opportunities to learn from exposure to different philosophies and approaches. For the educational collaborations that do exist, many operate on a small scale and are "often unknown beyond the area in which they are operating" (Clark, Tytler, & Symington, 2014, p. 29).

One documented example of collaboration in STEM education is the Preparation for Industrial Careers in Mathematical Sciences (PIC Math) program which partners higher education with industry in order to solve real-world problems offered by the industrial partners. The PIC Math program is funded by the National Science Foundation in collaboration with the Mathematical Association of America and Society for Industrial and Applied Mathematics. During a semester long course, professors work with small teams of college undergraduates who analyze data and present solutions to issues identified by industrial partners. In the process, undergraduates gain skills which better prepare them for careers in their chosen industry (Joyner, 2017).

Purpose of the Project

Solutions to the challenges of implementing integrated STEM with elementary students are difficult to find. New standards and other demands place practicing teachers with already severely limited time constraints under further strain. Pre-service teachers feel the strain as well. This unease can be due to a variety of factors, beginning with their own prior experience coming up through K-12 education under a system that devalued integration in STEM areas. Later, this may continue with a resulting lack of familiarity with early/elementary STEM integrated activities, and culminating with their current potentially negative attitudes, beliefs, and self-efficacy. These problems are exacerbated by departmental isolation.

In order to address the challenges of implementing integrated STEM, we initiated a collaboration between our laboratory school elementary teachers, pre-service teachers, and education professors (Figure 1). Similar to the way that the PIC Math partnership connects industry with STEM content majors, we asked the elementary teachers to identify authentic problems involved with the teaching of new science standards and then we supported pre-service teachers in solving those problems through plans for integrated STEM activities. The following question guided our work: *How can collaboration between elementary teachers, pre-service teachers, and education professors solve problems related to the implementation of integrated STEM education?*

This collaboration was intended to alleviate several of the difficulties discussed previously. Through the collaboration we sought to: 1) leverage the time and energy of pre-service teachers to assist elementary teachers in the integration of science and mathematics; 2) provide additional hands-on experience through microteaching for pre-service teachers by engaging them in solving authentic problems related to elementary STEM teaching and learning; and 3) increase professionalization of the workforce through collaboration across departments and by fostering relationships between pre-service teachers and practicing teachers. What follows is a detailed description of the methods we employed and the initial outcomes from this development phase. In the conclusion, we identify key features of the collaboration that emerged that contributed to the advancement of integrated STEM in elementary education, implications of this approach, and our plans for the future.

Project Overview

General Organization

The project described below has evolved over multiple years. In Year 1, the project was conceived by elementary education professors as a way to help elementary teachers at a partner laboratory school as they transitioned to a new and challenging set of state science standards. Furthermore, it was intended to benefit pre-service teachers through authentic and challenging experiences planning hands-on science learning activities and professors by enhancing the program in which they served, while positively impacting elementary students in science. In Year 2, the project expanded to address integrated STEM and added professors and pre-service teachers in the early childhood education program. At the time of writing, the team was planning and beginning implementation of Year 3. Unless otherwise noted, this paper focuses on Year 2 of the project. Table 1 summarizes the contributions by each group of collaborators during the project.

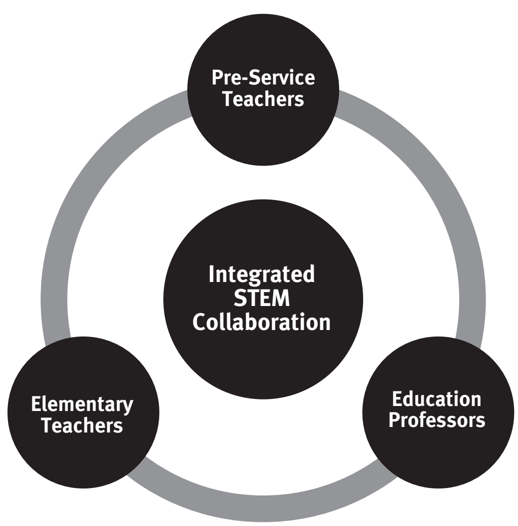

Figure 1. Collaboration to Implement Integrated STEM in Elementary Education

	Pre-service Teachers	Elementary Teachers	Professors
Contributions	Completed in-depth analysis of the standards Identified integration points Designed learning experiences Implemented microteaching of one hands-on learning activity Shared created materials with elementary teachers	Identified “problem” standards Shared exemplary science examples and tips Gave feedback on the projects at two points Scheduled time and brought elementary students for microteaching	Initiated the collaboration Designed project requirements for pre-service teachers Developed timeline for collaboration Modeled best practices Supported pre-service teachers in project development Facilitated logistics and communication Evaluated pre-service teachers’ work and provided feedback

Table 1. Summary of Contributions by Each Group of Collaborators

Timeline. The collaborative project for Year 2 took place over the course of one semester during which the pre-service teachers were enrolled in a course related to STEM in either an elementary education program or an early childhood education program. Table 2 is a timeline of the major events of the project during the semester. The semester at our institution includes 14 weeks of coursework and one week for finals.

Week of Instruction	Major Events
2	Elementary teachers provided a list of the most difficult science standards which they would like pre-service teachers to address. Professors created a shared spreadsheet to organize the list of standards. Collaborators finalized and coordinated dates and times for microteaching experience during finals week (week 15)
4	Pre-service teachers selected their preferences for a grade level and Disciplinary Core Idea (DCI) for the project.
5	Professors coordinated standard selection by pre-service teachers using a shared spreadsheet. Pre-service teachers finalized the grade level science standard for their projects.
6-14	Pre-service teachers worked on projects. Required elements included integrating mathematics (and other subjects in early childhood program), reviewing relevant STEM content, and planning learning activities. Professors, in their respective courses, modeled and provided instruction on best practices in STEM, helped pre-service teachers identify mathematics standards for integration, reviewed projects, and provided feedback.
11	Elementary teachers met with pre-service teachers that were working on a standard for their grade level to share an exemplar science unit and to offer tips and suggestions for student projects. Pre-service teachers had a work session for their projects and could ask questions of the visiting elementary teachers. Pre-service teachers from elementary education and early childhood education discussed their projects comparing different approaches.
15	Pre-service teachers led hands-on learning activities for elementary students and reflected on their experiences. Elementary teachers observed projects, shared feedback, and facilitated safety and management of elementary students. Professors facilitated safety and timing of microteaching and collected reflections from pre-service teachers and interviewed elementary teachers.

Table 2. Timeline of Major Events

Participants. The project included four elementary teachers, four professors, 59 undergraduate pre-service teachers, and six graduate pre-service teachers for a total of 73 collaborators in a university setting in the southeast United States. The elementary teachers were from grades kindergarten (five years of age) through three (eight years of age). The pre-service teachers were enrolled in one of three courses related to STEM education: *STEM Content for Elementary Educators* (undergraduate elementary education), *Constructivist Inquiry Approach to Science/Mathematics for Young Children* (undergraduate early childhood education), or *Constructivist Inquiry Approach to Science and Mathematics for PreK-3* (graduate early childhood education). The elementary teachers were employed by the university's K-12 laboratory school. The lab school culture embraced collaborations with pre-service teachers, but elementary science collaborations had been on a smaller scale and not in such an integrated fashion.

Description of the Process

Identifying authentic problems. The problem faced by elementary teachers in this collaboration was the adoption of new and challenging science standards. Although the state did not formally adopt *NGSS Science Standards* (NGSS Lead States, 2013), the same guiding document, *A Framework for K-12 Science Education* (National Research Council, 2012) was used to develop the state science standards. The new science standards (15-25 standards per grade level) required changes in planning, instruction, and assessment, and the elementary teachers had little time available to commit to re-designing their curriculum. As a part of the collaboration, elementary teachers reviewed the new standards and selected the standards about which they felt the most concerned. This list was primarily composed of physical science and engineering standards, but all of the disciplines were represented on the list. The identified standards were then used as the basis of the projects created by the pre-service teachers.

Structure of projects by pre-service teachers. Each pre-service teacher was tasked with designing an integrated STEM unit of instruction that focused on one of the science standards identified by the elementary teachers. The projects for both elementary and early childhood education were based on prior semesters' assignments and differed in their specific requirements; however, it was possible to address the needs of the elementary teachers through both formats. Small changes to the structure of the projects were made without re-designing the projects. In the elementary education program, the project requirements were to create a 5E Learning Cycle (Bybee, 2015) that integrated one mathematics and one science standard. The final product also had to be organized into an interactive notebook format (Marcarelli, 2010) that included two Claim Evidence and Reasoning ([CER]; Zembal-Saul, McNeill, & Hershberger, 2013) writing activities and assessments for mathematics and science. Pre-service teachers created electronic and hard copies of the interactive notebooks to share with elementary teachers.

In the early childhood education program, the project requirements were to create a two-week integrated unit plan, with the selected science standard at the center. Pre-service teachers had to create a curriculum web, two full lesson plans, descriptions of activities across the day and across the two weeks, an assessment plan, and to discuss how activities were connected to one another. Pre-service teachers had to link the activities to standards in a number of other domains, including mathematics. A critical element of this assignment was to identify how the activities would allow for elementary students to engage in inquiry or scientific practices and to be active in their learning (rather than a focus on direct instruction), for example, through using the 5E cycle as a framework. Early childhood educators provided the integrated unit plans for the collaborating teachers.

Supports during project development. To support the pre-service teachers in the development of their projects, the professors scheduled multiple points for feedback and revision throughout the semester. In an effort to provide maximum feedback, up to three people (two professors, one graduate assistant) would review submitted work to provide focused feedback. Smaller assignments helped break the projects into manageable pieces over the semester to encourage pre-service teachers to avoid procrastinating until the end of the semester. Pre-service teachers learned to "unpack" standards (Table 3) using a template adapted from a local school system (Sullivan County Schools, n.d.). Significant time for support and feedback was provided during the weeks when pre-service teachers were trying to find a mathematics standard that fit well with their assigned science standard. To locate points for integration, pre-service teachers created concept maps of math topics, and they discussed the difference between surface level and deep integration.

STEP 1	Standard as it appears in the Standards (copy/paste):		
STEP 2	Initial Gist:		
STEP 3	**A** Nouns / Noun Phrases:	**A** Verbs / Verb Phrases:	**B** Webb's DOK levels:
STEP 4	Key Academic Vocabulary: (indicate those that need to be clarified or directly taught)		
STEP 5	Discussion notes: (What comes before/after this standard? What prior knowledge/skills are needed to master this standard?)		
STEP 6	New Understanding: (May write this as an "I Can" statement)		
STEP 7	**A** Instructional Implications (i.e., activities/strategies/writing):	**B** Assessment Implications (formative and summative):	
STEP 8	How will you differentiate to meet the needs of your students?		

Table 3. Unpacking Standards Guide (Sullivan County Schools, n.d.)

Built into the projects early in the semester were opportunities for the pre-service teachers to review and extend their CK related to the mathematics and science of their project standards. The pre-service teachers researched their topics and created concept maps of the major science ideas. Some of the mathematics and science concept maps were incorporated into the final project while others were only used as reference tools during planning. In the early childhood education program, pre-service teachers reviewed the state standards and the NGSS, and then prepared, presented, and received peer feedback on hands-on science activities delivered during class that covered the major disciplinary core ideas. These in-class ideas supported pre-service teachers' CK and PCK, while also preparing them for the teaching experiences to come.

The pre-service teachers also received support through examples of best practices shared by the professors and the elementary teachers. The professors, in their respective classes, modeled integrated STEM teaching and assessment regularly with projects such as pancake engineering (Chizek, VanMeeteren, McDermott & Uhlenberg, 2018; Flynn, 2017) and explorations of sinking and floating (Merritt, Jimenez-Silva, Rillero & Chavez-Thibault, 2018). Assigned readings from practitioner journals such as *Science and Children* and *Teaching Children Mathematics* also provided examples of high-quality STEM for elementary students. Additionally, the early childhood pre-service teachers had a guest lecture from a mathematics professor in the elementary education program.

Later in the semester, special class meetings were arranged so that pre-service teachers of both programs could meet for one hour with the elementary teacher for whom they were designing a project. The elementary teachers each brought one exemplar science unit to share with the pre-service teachers and shared tips and recommendations. For example, the second grade teacher discussed how she looked at both the first and third grade standards in her planning to understand what prior experience students were likely to have and what she needed to prepare them for in the third grade. The kindergarten teacher shared that she did not hesitate to use content vocabulary with her students because they were ready for, and enjoyed using, the terms that described science phenomena. While the elementary teachers visited, there was also time for the pre-service teachers to work on their projects, discuss their projects with peers from the other education program, and ask the elementary teachers for feedback.

Microteaching of hands-on activities. The project culminated with the pre-service teachers implementing one of the hands-on learning activities from their projects with elementary students in a microteaching format. This occurred at the end of the semester during the two-hour final exam period. Pre-service teachers worked with a peer that had a standard from the same grade level. The first 30 minutes of the period were for preparing materials and activity setup, and the last 30 minutes were for clean up and reflections (Table 4). The elementary students and teachers arrived for the hour in the middle. During the hour, small groups of elementary students rotated through activities for their grade level every 15 minutes. Each pre-service teacher taught an activity two times and served as an assistant for a peer two times. This allowed the pre-service teachers the opportunity to receive immediate feedback and make small revisions the second time they taught, and it allowed them to get a different perspective as an observer/assistant. Pairing up the pre-service teachers also meant that someone was available to support the teaching experience if there were management or materials issues. During this time, the professors and elementary teachers provided assistance as needed.

Time	Events
30 minutes	Pre-service teachers prepare materials.
60 minutes	One pre-service teacher leads an activity while a peer assists (15 min). The pre-service teachers switch roles (15 min). Elementary students rotate to a new group, and the pre-service teachers repeat their activities with new students (30 min).
30 minutes	Pre-service teachers clean up and complete reflections.

Table 4. Schedule for Microteaching with Elementary Students

Logistics and communication. A flexible logistical plan was used to coordinate the work of 73 people. Prior to the start of the semester, the elementary teachers and professors met to discuss the project, set action items, and plan the days and times for elementary students to visit for the microteaching experience. The college final exam periods were used for microteaching hands-on activities with small groups of elementary students; the culmination of the project. These dates and times were scheduled five months in advance in order to ensure that they would work for the elementary teachers and students. This was also necessary in order to determine which course sections of pre-service teachers addressed which standards and reserve classroom space during final exams. With the most important dates set, other parts of the timeline such as due dates for smaller assignments, class activities, and project work time could be modified during the semester as needed.

An online survey was used to determine the grade level and DCI preferences of the pre-service teachers. Pre-service teachers were assigned to a small group based on a grade level and discipline (i.e., 3rd grade physical science), and then each student selected one of the identified problem standards to address. A shared, cloud-based spreadsheet was used to organize which pre-service teachers were addressing which standards across the different education classes.

Email was the primary method of communication used between the professors and elementary teachers. Communication was on-going, but there were planned methods for collecting feedback from the pre-service teachers and elementary teachers at the end of the project. On the day of microteaching, the pre-service teachers completed a short, written reflection about what they learned from working with the elementary students and what they learned from the project as a whole. On the same day, one of the professors conducted a short interview with each elementary teacher for feedback on the projects created by the pre-service teachers and the collaboration.

Outcomes

The collaboration to implement integrated STEM resulted in observable benefits to each group of participants which fall into two categories, 1) materials (physical products) and 2) experiences and opportunities (see Table 5). Year 2 of the project provided initial pilot data collected primarily through anecdotal observation and informal feedback.

	Pre-service Teachers	Elementary Teachers	Professors
Materials	Shared projects of peers	Integrated unit with materials New hands-on teaching ideas to address standards integration	Improved course content due to authenticity and feedback from elementary teachers
Experiences and Opportun-ities	Authentic, challenging experiences Opportunity to work with elementary students Exposure to integrated STEM, best practices, and high quality resources Opportunity to observe and assist a peer during microteaching Opportunities to engage in the profession through publications, presentations, and sharing of ideas	Opportunity to observe hands-on activities during microteaching Opportunity to present at professional conference and co-author publications Participation can count toward tenure requirements	Ability to provide opportunities for pre-service teachers to work with elementary students Participation may help with tenure and promotion criteria Exposure to philosophies of other pre-service programs serving same grades

Table 5. Summary of Benefits to Each Group of Collaborators

Materials

This collaboration resulted in the production of 65 integrated STEM units for grades kindergarten through three. By grade level, this amounted to 14-18 units, in electronic and hardcopy formats, for each of the four elementary teachers. In addition to materials that were specific to the project requirements of each department, each unit addressed a science standard that had been identified as challenging by the elementary teachers and included at least two hands-on learning activities (one of which was field tested during the microteaching), materials lists, activity directions, assessments, and reference lists. The materials were shared with the elementary teachers and among the pre-service teachers. The collaboration also led to revised teaching materials and projects for STEM courses in pre-service teacher programs; the professors made changes to their course materials and the progression of the collaboration based on feedback from the elementary pre-service teachers.

Experiences and Opportunities

The experiences working with elementary teachers and elementary students were valuable for the pre-service teachers. Anecdotal evidence from written pre-service teacher feedback indicated that some pre-service teachers learned that their hands-on activities were not as engaging as they had imagined, while others learned that they had underestimated the capabilities of elementary students. The microteaching component was also valuable for the elementary teachers, because they were able to see all of the projects that had been created to address their standards carried out consecutively, which is a more engaging and time-saving experience than only receiving a packet of printed unit plans that they would need to visualize, prepare, test, and adapt on their own. One teacher noted, "I liked the cloud in a jar activity for the water cycle and the severe weather marshmallow activity. I'd known about that standard, but hadn't thought to try a hands on activity like that."

As stated in Table 5, a benefit to the professors was that the Early Childhood Education (ECE) and Elementary Education programs were able to bridge a departmental and programmatic divide that is rarely breached. Indeed, university faculty from the early childhood department reported learning about approaches in elementary education, such as the claims, evidence, reasoning approach (Zembal-Saul, McNeill, & Hershberger, 2013), and the faculty intend to integrate this approach in future classes. In addition, the elementary professors learned that pre-service teachers in the early childhood program used more hands-on approaches to learning and more frequently integrated subjects. There was also crossover learning for the professors in other disciplines. For example, the mathematics professor in elementary education learned new theories and approaches to teaching science, while the science professor was exposed to new strategies for teaching mathematics.

Both groups of pre-service teachers also learned from one another. The ECE pre-service teachers appeared more comfortable with planning and implementing hands-on materials and activities during the culminating teaching experience, while some of the elementary school pre-service teachers were surprised by the less-than-ideal level of engagement of the children with lessons that were focused heavily on paper-and-pencil activities. The elementary group used more written documentation in their teaching experiences than did the ECE group, and the ECE pre-service teachers noticed this and discussed including more documentation in future work with elementary students. Both groups took away something valuable from this experience of working side-by-side with peers from another program.

Sharing the projects with the elementary teachers of the laboratory school was a requirement of the project; however, there were several other opportunities for pre-service teachers to share their projects with a broader audience. All of the pre-service teachers were invited to share their projects with classmates and others through the university website. With their permission, pre-service teachers' projects were organized by grade level and standard and posted online for others to download. Additionally, 10 pre-service teachers were invited to co-present their projects at education conferences. As a result, three pre-service teachers presented at a regional conference, and one pre-service teacher presented at a state conference. Two of our pre-service teachers were co-authors on manuscripts, based on their projects, that were published in practitioner journals (Lange, Lodien, & Lowe, 2019; Robertson, Dunlap, Nivens, & Barnett, 2019).

Discussion

The intent of this project was to address the challenges of implementing integrated STEM in elementary education through an innovative collaboration between pre-service teachers, elementary teachers, and education professors. As a result, we created new materials and provided all parties with opportunities to increase knowledge and experiences with integrated STEM in elementary education. When we started, the specific details of the Integrated STEM Collaboration (Figure 1) were not fully developed, but upon its completion, we identified five key components of our approach that were essential to its success (Figure 2). Accordingly, the key components align most closely with the implementation features of the Descriptive Framework for Integrated STEM Education (NRC, 2014). We theorize that the key features of our collaboration led to impacts on the attitudes, beliefs, self-efficacy, knowledge, and practice of the three groups of collaborators, and we plan to formally investigate these impacts in the future.

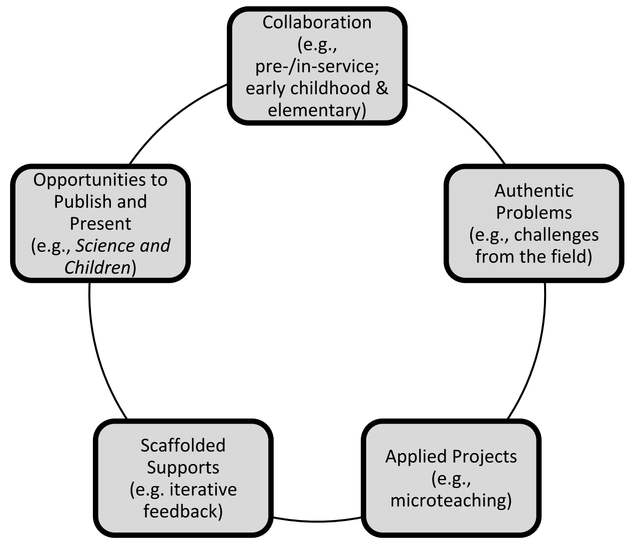

Figure 2. Key features of the Integrated STEM Collaboration

The first key feature of our project was collaboration among different types of STEM educators. The NRC describes this as adjustments to the learning environment (2014). The challenges of planning and implementing integrated learning activities have been documented (Paolucci & Wessels, 2017; Shernoff, Sinha, Bressler, & Ginsburg, 2017; Stohlmann, Moore, & Roehrig, 2012) and with new standards being adopted in our state, teachers were under more pressure to develop new learning activities. Each group of collaborators in the project made specific contributions to the project. Similar to the PIC Math collaboration, elementary teachers that served as our "industry" partners in the present project identified challenging standards from the newly adopted state science standards, and the pre-service teachers were tasked with finding sound and previously unknown approaches to teaching the standards in an integrated way. The pre-service teachers provided time to the collaboration addressing one of the primary barriers cited by teachers and administrators to the implementation of integrated STEM (Shernoff, Sinha, Bressler, & Ginsburg, 2017). Opportunities for the collaborators to interact during the project expanded their understanding of educational philosophies and practices. For example, File and Guillo (2002) found that pre-service teachers in ECE programs tended to report beliefs that were more in line with the National Association for the Education of Young Children's (NAEYC) guidelines, which are heavily constructivist, than did the elementary education pre-service teachers.

Using the concept of microteaching (Cinici, 2016; He & Yan, 2011), pre-service teachers applied their learning and were able to make gains in their own CK, as evidenced from their self-reported feedback at the end of the semester. While Donna and Hick (2017) showed CK gains among pre-service teachers while in their field placements, our project provided opportunities for pre-service teachers to gain knowledge by bringing elementary students to the university classroom. As an anecdotal example, our pre-service teachers expressed confusion about "pictographs" (a 2nd grade common core mathematics standard) and "scaled-pictographs" (a 3rd grade common core mathematics standard). Such nuances in standards become much more evident when pre-service teachers have to apply and teach activities they envision to be aligned with the standards. Although this was an effective technique for many pre-service teachers, we also found evidence that not all of them learned the underlying content, mirroring findings by others that it is critical that STEM instruction include information about the generic or abstract concept in addition to the more perceptually-rich version (NRC, 2014).

There were multiple scaffolds provided to help pre-service teachers succeed with the challenges of designing and teaching integrated STEM. Throughout the semester, pre-service teachers had opportunities to receive and respond to feedback from their professors, peers, and elementary teachers. Likewise, instructional design, a key factor that contributes to implementation of integrated STEM (NRC, 2014) was scaffolded in the structure and required components of the projects. Best practices such as the 5E learning cycle (Bybee, 2015) were modeled for pre-service teachers in class sessions to address common mistakes in integrated instruction such as only connecting concepts in a superficial way (Heimer & Winokur, 2015). In the case of the pre-service teachers, the entire experience of planning and teaching integrated STEM in their preparation is a form of educator support, and it may result in an openness to integrated STEM once they are in their own classrooms.

This collaboration resulted in pre-service teacher presentations at state and regional conferences and publications in practitioner journals. Prior to this project, opportunities for pre-service teachers to publish or present were extremely limited. Professionalization of the teaching workforce is lacking, especially in early childhood education (Boyd, 2013). As participants engage in aspects of the profession, the engagement has long-ranging effects. These opportunities may increase the self-efficacy of the pre-service teachers and how they see their role as professionals (Pajares, 1992; Greenfield et al. 2009), and may make them stronger job candidates. Future work will formally evaluate the extent to which our approach led to changes for pre-service teachers in knowledge, PCK, attitudes, beliefs, self-efficacy, and teaching practice.

Conclusion

Limitations

The limitations of this project include the setting of the collaboration and the lack of formal data collection. The project was conducted with a small number of elementary classrooms at a K-12 laboratory school located on the campus of a university. The elementary teachers and professors had existing relationships and levels of professional trust prior to the start of the collaboration. Furthermore, the elementary teachers at the laboratory school have greater autonomy over their curriculum and schedules than typical elementary teachers. Additionally, this project was implemented with data collection limited to informal interviews and anecdotal records. Future work will formally measure the extent to which the described project can impact collaborators. We will also consider how a collaboration such as ours might function in other settings or educational contexts.

Implications and Next Steps

Due to the challenges of integrated STEM, collaborations between elementary teachers and higher education offer a path toward large-scale problem solving. In the course of this collaboration, all groups benefited from the contributions of others because of a focus on authentic problems. For maximum impact, collaborations should be structured in such a way as to strengthen relationships and trust while efficiently managing resources, especially time. It is our belief that this model could be adapted for any context that a teacher or set of teachers faces. For example, this model could extend to other areas within education, such as literacy, or outside of education, such as psychology. Potentially, participation in these types of opportunities for collaboration could be extended to professional development for in-service educators.

The next steps for this program include designing and carrying out a research study that quantitatively evaluates the effects of this intervention. We will evaluate immediate impacts on collaborators, such as changes in pre-service teacher attitudes towards teaching science, as well as longer-term outcomes, such as continued use of the lesson plans developed by the pre-service teachers in the mentor-teacher classrooms in subsequent years. In the future, it would be beneficial to explore the collaboration in more inclusive school settings, including schools that are racially and ethnically diverse and schools with challenging socio-economic demographics. The age range of the student participants could be extended, as well, for example by including pre-school classes, and the scope of the concepts addressed could be extended by allowing university staff to come up with additional lesson topics. Other ideas for further development of this type of collaboration include: the addition of book club style discussions of readings based on STEM content or teaching and learning theories, encouraging or requiring additional use of shared materials, and having pre-service teachers conduct a second or third iteration of their teaching activity after allowing them additional time to revise their microteaching lesson following the initial field test.

In closing, we are encouraged by the early rollout of this innovative, collaborative endeavor. All groups of contributors reported benefitting from the collaborative experience, and observations indicated that the elementary students benefited from the microteaching experience. We have plans to further develop this model in the coming years, because we strongly believe that this style of multi-level collaboration has the potential to influence large-scale change in the way that pre-service teacher programs function and in the ways that STEM standards are taught in early childhood and elementary classrooms.

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Applicable Lessons from Select Laboratory Schools Throughout the United States

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Introduction

Many institutions of higher education offering teacher preparation programs are constantly exploring best practices which can enhance the teaching and learning process. As a result of a grant through the Virginia Department of Education and in partnership with Smyth County Public Schools, Emory & Henry College Education faculty members conducted research in relation to STEAM and 21st Century learning skills. Through the collaborative partnership, the focus of the grant was to examine effective, innovative, and research-based practices for Kindergarten through grade five classrooms using a STEAM framework and 21st Century learning skills. The acronym STEAM refers to the traditional four areas of Science, Technology, Engineering and Math (STEM) with the addition of Arts. The rationale for exploring a STEAM model is based on numerous studies in cognitive science and neuroscience indicating that long-term retention of content in core subjects is enhanced through the arts (Sousa & Pilecki, 2013). In conjunction with the STEAM framework, 21st Century learning skills such as critical thinking, problem solving, communication, collaboration, creativity, and innovation were also a focus of the research given their importance in a 21st century global economy (Trilling & Fadel, 2009). Linkages are evident in that along with the continuing demand for STEM proficiencies, "there will be even higher demands for creativity, invention, and innovation. As such, the arts have been a traditional source for developing creativity" (Trilling & Fadel, 2009, p. 104).

The research process included visiting and researching model collaborative college/university partnership programs and innovative, interdisciplinary, performance-based STEAM education methods. During 2013, four laboratory schools met the criteria and included Falk (University of Pittsburgh), Edith Bowen (Utah State University), LSU and UCLA. Following IRB approval, data collection at each school included semi-structured qualitative interviews with faculty, staff, and students as well as multiple observations by members of the research team. The coding scheme applied to the site visit data reflected the overall research question of "What are the effective structures for implementing a STEAM curriculum in an elementary school setting which are foundational and facilitate learning outcomes widely identified as essential for 21st Century learners (e.g. critical thinking, problem solving, creativity and innovation, communication and collaboration)?" Therefore, the purpose of this article is to explore themes developed as related to 1) school culture, 2) leadership capacity, 3) expectations of student performance, 4) rigor and alignment of curriculum, 5) attention to student voice, and 6) engagement. The following sections provide an overview of key findings from each theme as related to STEAM and 21st Century learning skills. As a result, the data collected has applicable relevance for public education institutions throughout the United States.

School Culture

According to the authors of *From STEM to STEAM*, school leaders such as principals or school directors greatly influence the school climate and culture (Sousa & Pilecki, 2013). At each laboratory school, the culture reflected a community oriented, collaborative, and holistic approach from the top down. School directors and/or principals exhibited a genuine passion for their school "family" and interacted very positively with faculty, staff, and students. Teachers exhibited a great sense of pride affiliated with their role as professionals in each lab school community. Data collected through observations and interviews indicated that everyone appeared to work cooperatively from an interdisciplinary approach to ensure the best possible experience for the children. Comments from teachers emphasized their commitment to providing a learning experience embracing the multidimensionality of each individual child. Throughout the time spent at each institution, there was evidence supporting a positive, child-centered learning environment. According to field notes from one member of the research team,

> "Learning is child-centered and experience based. There is collaboration instead of competition. Learning can be described in three ways: 1) child centered; 2) experiential; and 3) cooperative and collaborative."

When asked by members of the research team to describe the philosophy of the school, parents from Edith Bowen used a variety of terms to explain how the school embodied a philosophy of "very experiential, hands-on learning, child-based, social constructivist, and Dewey-like." In a similar fashion, parents from UCLA also described a school culture reflecting the scholarship of John Dewey. This philosophy was also echoed in statements by Norma Silva, UCLA Laboratory School Principal.

> "Our roots go back to John Dewey. Our purpose as a laboratory school is to prepare students to be active, educated participants in our democracy and our global society."

The reference to John Dewey mirrors the sentiments of noted neuroscientist Authur Reber, who encouraged a more implicit, hands-on approach to learning (Jensen, 2001). When asked how their children would describe the school, parents used the word "*fun*" and said that their children came home talking positively about subjects such as science. Teachers at Edith Bowen reiterated similar themes by stating that the school adhered to a "constructivist teaching philosophy, hands-on learning, dynamic learning environment, place-based education, and project-based education."

Another aspect of school culture related to the sense of community. The evidence of a community-centered approach at each school helped to build a sense of intellectual camaraderie, which ultimately influenced the learning process in fundamental ways (National Research Council, 2000). The school culture at all four schools revolved around providing a creative and innovative experience for students and teachers. For example, LSU parents described their school as "innovative, willing to try new things, willing to experiment, and a model of excellence for what education should be." As stated by Trilling and Fadel (2009), "creativity and innovation can be nurtured by learning environments that foster questioning, patience, openness to fresh ideas, high levels of trust, and learning from mistakes and failures" (pp. 57-58). A culture of inquiry as an important part of the learning process at each lab school was guided by efforts to ask essential questions to further stimulate student thinking (McTighe & Wiggins, 2013). Data collected specific to the theme of school culture aligns with both STEAM and 21st Century learning skills through the incorporation of a more experiential, project based experience in which collaboration, creativity and innovation is encouraged and supported (Sousa & Pilecki, 2013; Trilling & Fadel, 2009). The next section includes a discussion of how the theme of leadership capacity is linked to STEAM and 21st Century learning skills.

Leadership Capacity

In analyzing the data gathered from all four schools, leadership capacity was considered from two perspectives. The first considered leadership capacity as related to administration, faculty, and staff. The second perspective considered leadership capacity in relation to building the capacity for students to become leaders. In terms of leadership, Professional Learning Communities (PLC) provided teachers at Edith Bowen a way to work collaboratively to develop curriculum and learn about topics of interest. These PLC meetings occurred once a week and included discussions regarding what content was being covered in the Common Core, how it could be covered from an interdisciplinary approach, and how to assess. Teachers also used the "PD 360" program for professional development to learn strategies and keep abreast of educational research. The PD 360 program is a web-based professional learning resource for teachers including a personalized learning experience utilizing best practices in education (www.pd360.com).

Leadership of the faculty was evident at Edith Bowen in that Director Dan Johnson provided opportunities for them to teach one another. In addition to attending conferences, teachers were also encouraged to present to one another. In a similar fashion, teachers at LSU highlighted the importance of each grade level being provided with a professional development day once per month to collaborate and work together in lieu of attending conferences. This time was used to plan collaboratively across each grade level and learn from one another regarding best practices. The schedule also included vertical planning time where teachers in grades below and above were able to touch base regarding the "how" and "why" of content being taught. At each school, the leadership structure supported teacher autonomy as they consistently worked to refine and revise their curriculum. As a result, teachers also felt empowered as leaders in their classrooms and the school rather than feeling that external central office personnel were dictating all aspects of the teaching and learning experience. At Edith Bowen, for example, the Common Core was *what* students learn but teachers had full autonomy regarding *how* it was taught. Additionally, each school was very focused on the *process* of learning rather than just on the *outcome* (high test scores). Even though all four schools followed certain state education guidelines in terms of the content being taught, they also felt empowered to provide an educational experience based on what they felt was professionally appropriate in relation to instruction. Findings regarding leadership capacity related to administration, faculty, and staff support a STEAM framework which encourages "students [to] become deeply engaged in relevant and meaningful learning activities" (Rufo, 2013, p. 4). The findings also support a 21st Century educational experience which empowers everyone to make informed decisions through both distributed and coordinated leadership as well as professional development opportunities (Trilling & Fadel, 2009).

Building leadership capacity in the students occurred in a variety of ways. For example, students at Falk developed their leadership skills through buddy reading time. During this time, Kindergarten students were asked to pick out a book that they wanted read to them by a third grade "buddy." Prior to the actual reading time, observation field notes indicated that third grade students and their teacher discussed the importance of using appropriate and responsible social skills when their "guests" [Kindergarten students] arrived. Students were also encouraged to think about what types of inquiry-based questions they could ask the younger students based on the reading. Additionally, third grade students planned and gathered supplies for activities which they could lead with their buddy in the event that reading the book ended prior to the allotted time. Student leadership was also emphasized and encouraged in areas beyond the classroom in which by-stander intervention and social responsibility was stressed on the playground and during other unstructured times in which negative peer interactions could occur. For example, students assumed leadership roles at UCLA by using strategies they had learned through the Safe School System. One component of this approach is Cool Tools, which empowers students to recognize and resolve conflicts. At one point, the researchers had an opportunity to meet with a group of students for the purpose of sharing their thoughts about the school. Student comments included an articulate description of Cool Tools as a way to build leadership skills by managing disagreements and differences of opinions.

> "We would figure it out with Cool Tools and how to compromise so that the other person doesn't feel that their opinion doesn't matter."

The type of leadership opportunities provided to students supports a STEAM framework through the development of perspectives which empower them to understand that "problems can have multiple solutions and questions can have multiple answers" (Sousa & Pilecki, 2013, p. 18). Additionally, students are afforded opportunities to develop 21st Century learning skills which "use interpersonal and problem-solving skills to influence and guide others toward a common goal (Trilling & Fadel, 2009, p. 85). The next section includes a discussion of student performance expectations as related to STEAM and 21st Century learning skills.

Expectations of Student Performance

Expectations of student performance consisted of more than just the results on standardized tests. Parents and teachers both expressed support for students performing well from a holistic standpoint rather than only their academic achievement. Students were encouraged to achieve high levels of performance in all aspects of their educational endeavors. However, there was also an ongoing dialogue of how not always achieving the right answer or that there may not be a right answer for everything is a very acceptable part of the learning process. One classroom teacher reinforced this concept by including the following statement in large letters on her dry erase board:

"If you make a mistake, then you are learning."

This aligns with recommendations for a 21st Century educational experience which encourages opportunities for students to explore a topic or problem with the ability to explore what doesn't work or make sense as well as what does without fear of being labeled (Trilling & Fadel, 2009). This also aligns with a STEAM framework which supports a divergent thinking process incorporating multifaceted solutions (Sousa & Pilecki, 2013).

In relation to student performance, it was interesting to note the community perception of the schools. Parents commented that the community perception was often that students who attended the school must be really smart. However, several parents noted that this was not the case and referred to their own children who were at opposite ends of the learning spectrum. In contrast to the community perception, student demographics at Edith Bowen closely mirrored the public school system in terms of students with special needs and varying socioeconomic backgrounds. This was also the case at the UCLA Lab School where there was a concerted effort to create a student population mirroring the ethnic, socio-economic and linguistic diversity of the state of California. Regardless of where students ranged on the learning spectrum, the overall consensus was that students came away from the lab schools better prepared in a holistic sense due to the variety and differentiation of academic instruction and programming activities related to STEAM and 21st Century learning skills.

Rigor and Alignment of Curriculum

According to Krauss and Boss (2013), rigor is often measured based on the number of problems assigned and completed or the number of pages read. However, the rigor in project-based learning involves constructing well-crafted projects that encourage students to examine what they know in ways that can then be integrated with new ideas.

> "Problem-based methods far outshine traditional methods in developing 21st century skills like flexible problem solving and applying knowledge to real-world solutions, as well as critical thinking skills such as generating testable hypotheses and communicating more coherent explanations." (Trilling & Fadel, 2009, p. 112).

Students at all four schools were encouraged to enhance their problem solving abilities by being challenged with a large quantity of open-ended questions on a regular basis. The rigor and alignment of curriculum varied amongst the four schools with each emphasizing that they greatly minimized their use of packaged curriculums. UCLA administrators described their curriculum to meet the Common Core as "organically grown" and "emergent." However, in some instances, certain curriculums were utilized such as Engineering is Elementary (EiE), developed by the Museum of Science in Boston. A theme for the year with a focus on how that theme could offer endless possibilities for teaching core concepts was also utilized.

A main focus at all four schools was deliberate and systematic incorporation of both foreign language and arts as part of the curriculum. As related to STEAM, one instance of incorporating the arts into the curriculum was through a research project at the UCLA Lab School entitled "Following Kids, Not Scripts." This research involved a year-long science project which culminated in the creation of a painting to represent how force produces motion in a roller coaster. As noted earlier, research indicates that incorporation of the arts supports the rigorous nature of academic achievement (Jensen, 2001). Although there was no set curriculum specific to art at UCLA, art infusion evidence was prolific. For example, all students create portfolios of their thinking in sketchbooks. The sketchbooks follow them from the time they are four until they leave the school. Their expressions are not just free art. Instead, they record their thinking and observations specific to STEM areas such as science, thus infusing science with the arts to create a STEAM approach. The next section discusses the connection of student voice to STEAM and 21st Century learning skills.

Attention to Student Voice

Attention to student voice was evident both literally and figuratively. During the classroom observations, students were afforded many opportunities to develop their oral communication skills. At the UCLA Laboratory School, one elementary teacher facilitated a project with the students revolving around the question of "What is a scholar?" Students were asked to consider and discuss what constitutes a primary source as part of the assignment. In reflecting on how each individual child could become a "scholar" and follow their passions, emphasis was also placed on how each student could be an agent of change.

In many public school systems, a "good" teacher may be described as the individual who always has a quiet and orderly classroom. In contrast, the students at each lab school were provided with numerous avenues for oral expression and communication. These avenues did not always produce a quiet classroom but lab school teachers indicated that this was evidence of a "good" teacher in contrast to a quiet and orderly classroom. The interaction in the classroom supports recommendations by the National Research Council (2000) suggesting that students should help one another to solve problems by "building on each other's knowledge, asking questions to clarify explanations, and suggesting avenues that would move the group toward its goal" (p. 25).

Student voice was also evident in efforts to encourage creativity, which has multiple long and short-term benefits. Short-term benefits included observations indicating that students enjoyed the process of learning because they were often encouraged to construct creative ways of applying critical thinking and problem solving skills on a given topic. Long-term benefits included providing an educational platform through which vital 21st century skills such as creativity and innovation are supported and encouraged (Trilling & Fadel, 2009). From a global perspective, many education systems such as Finland and Singapore are including creativity and innovation in their desired outcomes for student learning.

Attention to student voice was also evident in various book selections such as *Roberto the Insect Architect* (Laden, 2000). Not only did this book introduce students to concepts at a very early age relating to the STEAM fields of engineering and architecture, but also included a discussion about how being different is a good thing. Students read the book and then followed up with individual displays of models created. Along the same lines, each school reinforced a deep appreciation and recognition that all students have a voice, even those who might learn differently. For example, a bulletin board at one school included photos of famous Americans with the title "Everyone learns differently." The photos included such individuals as Lincoln, Ford, Bell, Edison, and Franklin who all learned differently due to ADHD or Dyslexia. An emphasis on developing student voices accentuating a STEAM approach included recognition of noteworthy artists who use science. Visual images of artwork depicted on one bulletin board also included a narrative about the artist.

> "Andy Goldsworthy combined natural sciences with physics. He often took natural objects like plants and rocks, and arranged them in an unnatural or planned way. He needed to know what stones wouldn't crumble and how much weight everything could support. Many bridges are made in a similar way to this sculpture."

This is just one of many instances which can expose students to ways in which specific artists' works have a clear connection to science thus forming a STEAM framework (Sousa & Pilecki, 2013). According to Bender (2012), student voice and student choice leads to engagement, which is discussed in the next section.

Engagement

Student engagement occurred in a variety of ways. One way to consider engagement is through the active and attentive involvement of students as they learn. This process is much different than what Dr. Ron Diss, professor at Emory & Henry College describes as the "sit, get, spit, and forget" model evident in many traditional public schools. By utilizing a problem-based hands-on approach, each school was successful in effectively engaging students. Project-based learning is "one of the most effective ways available to engage students with their learning content" (Bender, 2012, p. 7). Student engagement was also reflected through the use of essential question strategies. According to McTigue and Wiggins (2013), "by tackling such questions, learners are engaged in *uncovering* the depth and richness of a topic that might otherwise be obscured by simply *covering* it" (p. 3). This aligns with STEAM scholars who suggest that the depth of an educational experience can be enriched when students are encouraged to move beyond just generating alternatives to solving problems (Sousa & Pilecki, 2013). Instead, students should be provided opportunities to generate unique and feasible ideas specific to particular problems or topics. During the focus group at UCLA, teachers stated that one way they successfully engaged students in critical thinking was to ask "Why?" all day long. As part of the learning process, students were also encouraged to express if they agreed or disagreed as well as providing a rationale for their decision.

As referenced earlier, Engineering is Elementary is a curriculum which encourages student engagement. EiE provides "hands-on, minds-on work with real **engineering practices** promoting the invaluable **21st-century skills** of critical thinking, collaboration, communication, and creativity" (www.eie.org). According to Trilling & Fadel (2009),

> "Students learn more deeply when they can apply classroom-gathered knowledge to real-world problems, and when they take part in projects that require sustained engagement and collaboration." (pp. 107-108).

Another way to consider engagement is in relation to the brain. According to Sousa and Pilecki (2013), incorporating the arts is one way to engage the young brain. Integrating various arts-related areas, such as music, has been linked to academic progress and represents one way to more fully engage students in the learning process. It is important to note (pun intended) that the positive impact of music on cognitive growth is mainly derived from "*taking* music lessons over time, which is distinct from the short-term effect of *listening* to music" (Sousa & Pilecki, 2013, p. 22). However, research has indicated that there are benefits to both (Jensen, 2001). A focus on cognitive growth and the incorporation of music was evident at each school. Observation field notes of a 3rd grade classroom at Falk indicated that the teacher played very low, soft music during self-directed work time. Additionally, by 4th grade, each child plays an instrument and has a minimum of one individual lesson per week on their instrument. Edith Bowen also offers multiple opportunities for students to take music lessons on a regular basis either during or after school. Research has indicated that in relation to a STEAM curriculum, math scores and special-temporal reasoning ability are positively impacted through music training (Jensen, 2001). At UCLA, music is always taught from a place of inquiry and facilitates student understanding from a sociocultural perspective.

Each school incorporated kinesthetic arts to varying degrees. According to Jensen (2001), kinesthetic arts "contribute to the development and enhancement of critical neurological systems, including cognition, emotions, immune, circulatory, and perceptual-motor" (p. 71). Kinesthetic arts can be dramatic, industrial, or recreational. Dramatic arts were a focus at both Falk and Edith Bowen. Industrial arts include sculpting, design, electronics, building, metal and wood working (Jensen, 2001). As related to industrial arts, hands-on engagement and inquiry was supported at the various schools through providing avenues for students to learn academic concepts while expressing and sharing their own unique personalities. For example, students at Edith Bowen were challenged to design and build their dream bedroom. According to documentation posted at the school, "students began by creating conceptual drawings using one-point perspective and then brought their ideas to life in three dimensions." An additional challenge included asking students to design and build a working light along with a functional switch or button. The three dimensional models were displayed in the library.

Recreational arts include physical education, classroom games, recess, sports, and active health programs (Jensen, 2001). The yoga studio at Edith Bowen was one example of how recreational arts as one aspect of a STEAM framework was included as part of the holistic student experience. Recess and free play were also provided on a regular basis at each school, which aligns with research indicating that unstructured play in the form of physical activity enhances cognitive development (Sousa & Pilecki, 2013). For example, at LSU, Physical Education was provided every day at the elementary school level. However none of the schools articulated efforts for systematic physical activity as related to neuroscience research linking the positive benefits of movement on academic progress (Hannaford, 2008; Ratey, 2008). A review of fifty research studies conducted by the Centers for Disease Control and Prevention (CDC) found a positive correlation between physical activity during school and academic success (Sousa & Pilecki, 2013). Therefore, kinesthetic arts and the value of movement cannot be overstated in relation to STEAM and 21st Century learning.

Conclusion

A plethora of data collected as a result of this research project generated valuable insight related to the topics of school culture, leadership capacity, expectations of student performance, rigor and alignment of curriculum, attention to student voice, and engagement. Overarching themes related to STEAM and 21st Century learning included a deep sense of connection encompassing many layers from the relationships among faculty with other faculty, faculty with students, faculty with parents, and students with other students. Additionally, each school embraced an environment that supported constant reflection, revision, and change. Individuals at all four schools pointed out several times that every aspect of creating a positive educational experience was an "evolving process" in which teaching is viewed as an iterative process of inquiry.

> "More than ever, the sheer magnitude of human knowledge renders its coverage by education an impossibility; rather, the goal of education is better conceived as helping students develop the intellectual tools and learning strategies needed to acquire the knowledge that allows people to think productively about history, science and technology, social phenomena, mathematics, and the arts. Fundamental understanding

about subjects, including how to frame and ask meaningful questions about various subject areas, contributes to individuals' more basic understanding of principles of learning that can assist them in becoming self-sustaining, lifelong learners." (National Research Council, 2000, p. 5)

The data collected as a result of this project has provided applicable insight regarding STEAM and 21st Century learning opportunities for what MacArthur Fellow Robert Root-Bernstein refers to as polymathic individuals who are able to "explore a range of possibilities across several domains of knowledge" (Dail, 2013, p. 1).

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Lab Schools: Past, Present, and Possibility

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Laboratory schools were an integral component of teacher education and preparation for the first half of the 20th century. There were many famous institutions namely, the Laboratory Schools of the University of Chicago. Challenges such as funding and dueling purposes eventually forced the majority of lab schools in the United States to close. Thanks to the support of the International Association of Laboratory Schools, there are still many lab schools in existence today. Most notable among these lab schools is the School for Children, which is associated with Bank Street College in New York. Although the affiliations and purposes of lab schools have changed over time, present day lab schools still adhere to the philosophy of John Dewey's progressive educational principles. Although facing similar challenges with funding like their predecessors, the structure of the lab school of today holds promise for the development of new schools in the future. With careful and creative planning, the laboratory school could be a promising option in addressing education reform.

Introduction

The first lab school was established in 1896 with the mission of advancing research and innovation in education. Initially intended to highlight the progressive educational ideals of John Dewey, lab schools became practice schools where novice teachers could learn to master teaching techniques, observe experienced teachers at work, and to try their hand at working with children (Green, 2014; Ohles, 1961; Thomas, 1956). This paper will trace the rise and fall of the original lab school model and provide examples of notable schools from both the past and the present. Finally, a tentative framework will be presented in order to show how possible it would be to create and sustain a lab school in the future.

Past: The Rise and Fall of Lab Schools

It is important to understand the origin of the lab school in order to fully appreciate the history of education in the United States of America. The influence of the lab school has had lasting effects on teacher education. Without the existence of lab school innovation at major universities such as the University of Chicago, the University of Missouri, Columbia Teacher's College, the University of Iowa, and the Ohio State University, schools as we know them today would be quite different. "The influence of these schools upon the thinking and practice of school people has, indeed, been great" (Thomas, 1956, p. 407).

Lab schools had specific characteristics that made them significantly different from public schools. They gained prominence during the early 20th century, but a mere fifty years later lab schools were struggling. This decline had ramifications for both teacher education and the advancement of teacher scholarship.

Purpose and Characteristics of Lab Schools

In 1896 John Dewey opened the doors of the first laboratory school in Chicago, Illinois with the intent of testing, practicing, and evaluating his progressive, child-centered learning theories (Abrahams, 2011; DePencier, 1996; Glennon, Hinton, Callahan, & Fischer, 2013; Null, 2011; Sparks, 2015). The lab schools of the past had several key components that characterized them. First, the schools were integrally associated with a university. They were "housed generally in Psychology or Home Economics Departments, the purpose of these laboratory schools was to conduct research, service and training related to children and families" (Wilcox-Herzog & McLaren, 2012, p. 1). A second key characteristic of the lab school was that of training pre-service teachers. They provided a convenient location for beginning teachers to observe best practices and then complete their clinical experiences, much like a teaching hospital in the medical field (Gresham, 2012). Gresham recounts, "from the beginning, the university embraced lab schools with a two-part mission: 1) to better prepare teacher educators; 2) to provide an exemplary instructional program for children where theory was modeled for teacher candidates" (p. 1). Third, it was understood that the lab school would provide a venue for producing and refining professional practices (Smith, 1914). The student teachers could in essence, "learn by trial and error" (Ohles, 1961, p. 390) while in the lab school classroom. And fourth, lab schools provided an opportunity for the teachers working in them to design and develop curricular materials such as textbooks and unit plans (Harms & DePencier, 1996; Perrillo, 2016).

One of the benefits of the laboratory school was that new teaching practices were accepted more quickly than in the public schools, thus teachers were using the most up-to-date practices to the benefit of their students and student teachers (Rehage, 1953). In addition, the lab schools were celebrated for moving beyond the idea of children as receptacles of knowledge and focusing on students' interests (Thomas, 1956). Subject matter was drawn from both the academic content and the students' lives outside of the school building. Lab schools were, however, cautioned against using too much experimentation for fear that doing so could be a hindrance to children's education (Thomas, 1956; Ohles, 1961). One common criticism of lab schools was that they "served an elite and homogeneous population that consisted mainly of the children of university faculty and staff" (Abrahams, 2011, p. 110).

Notable Institutions

University of Chicago Laboratory Schools. Most notable of the lab schools is the school founded by John Dewey while he was at the University of Chicago. Still in existence today, it sheds light on the both the past and the present of laboratory schools and provides insight for the future. In the book *Experiencing Education: 100 Years of Learning at the University of Chicago Laboratory Schools*, William Harms and Ida DePencier (1996) provide a comprehensive history of John Dewey's brain child. Influenced by the ideas of European thinkers such as Johann Pestalozzi and Friedrich Froebel, the school opened in 1896 with only sixteen students. The school espoused the tradition of child-centered, real life learning. During the course of more than 100 years it gained notoriety with educators through out the world, both for its curriculum and the high level of scholarship produced by the faculty. For example, the concept of unit mastery has its origin in Dewey's Schools and the faculty was known for producing various educational books, textbooks, and scholarly journal articles.

The school was officially named the Laboratory School after the turn of the 19thcentury and grew from a small three-room school to a complex of buildings supporting the learning needs of over 2,100 students P-12 (Sparks, 2015). Much of the activity in the school was influenced by the collaboration between the faculty at the University of Chicago and the teachers. For example,

> testing was a constant occupation at the Schools, and not just to measure classroom performance. Psycho-physical tests were given at or around students' birthdays, weight and height increases were duly recorded and studied for insight into child development. The wrists of students were x-rayed to see how their bones were developing and the University's Home Economics Department studied child nutrition at the school to learn how students maintained metabolism (Harms & DePencier, 1996, p. 27).

Throughout the 20thcentury, the Schools mirrored the events happening in society. The daily life and lessons the students encountered were affected by wars, economic hardships, trends in popular culture, political unrest, teacher unionization, and the onset of the computer age. In addition, the Schools faced problems such as high teacher turnover and funding crises. More importantly the Schools endured the closing of the School of Education at the University of Chicago in the 1930s. Later, they embraced the introduction of the Master of Arts in Teaching program in 1954 and the opening of the Graduate School of Education in 1960. With each new challenge the school maintained momentum. A reorganization of the Schools in the mid 1980s occurred which resulted in creating a "structure similar to the model of organization used in other independent schools unaffiliated with universities" (Harms & DePencier, 1996, p. 72). By the 1990s the Schools had broken "their affiliation with the University of Chicago… when the university's education program was dissolved" (Sparks, 2015, p. 12). With strong support from parents, alumni, and community members, along with the commitment to innovation and experimentation in education, the Schools weathered the challenges and remain open today as a system of private, top-ranked college preparatory schools serving Chicago's elite.

Columbia University's Lincoln School. Jonna Perrillo (2016) provides a snapshot of the Lincoln School of the Teacher's College of Columbia University. Founded in 1917, it was "dedicated to the production of education research by practicing teachers" (p. 90). Inspired by John Dewey, the teachers of the K-12 lab school advanced educational research and curriculum development by publishing textbooks and numerous journal articles. Much like the Laboratory Schools established by John Dewey, professional educators from all over the world frequently visited Lincoln School to observe and learn through professional development workshops (Perrillo, 2016). With a student body of 116 pupils and twenty-five teachers, the Lincoln School engaged in creative lessons that prepared students for college entrance. Unfortunately, the school was plagued with issues of teacher retention, low salaries, and a lack of balance between classroom teaching and educational research. However,

> while these structural issues were real for Lincoln School faculty, the school's problem with turnover might be understood as a sign of success as well as a shortcoming. Many of the faculty who left Lincoln School did so not for other private schools but for positions in teacher preparation (p. 110).

These challenges coupled with the economic woes of the Great Depression eventually forced the merger of the Lincoln School with the Horace Mann School in 1941. According to Perillo,

> In contrast to the Lincoln School, the Horace Mann School was an established demonstration school, an institution dedicated to performing best practices rather than experimenting with them. As the trustees described it, the Lincoln School was a victim of its own success (p. 111).

Alabama State College Laboratory High School. Offering an interesting contrast to the laboratory schools in the northeastern portion of the United States is the Alabama State College Laboratory School. In an article about democracy in segregated schools of the south, Pierson (2010) traces the history of a segregated high school for African Americans that was established in the 1920s. It was inspired by John Dewey's Chicago based schools. The school served as a lab for college students in the field of education, was taught by highly qualified teachers, and offered students a curriculum rich in the liberal arts. Students at the school were aware of the great opportunity that was being given to them and they made the most of it by excelling in all areas of scholarship. The vast majority of students attending the school continued on to college. The ravages of the Civil Rights movement during the 1950s did not escape their notice, but the focus of the students' lives remained on their rigorous lessons since the location of the school on the Alabama State College campus "provided a rich, sheltered environment in which to grow up" (p. 189). Students at the school were held to high expectations both academically and socially. In addition, they were expected to "become future contributors to the nation and to the race" (p. 201).

Due to the same pressures affecting other lab schools of the era, the Alabama State College Laboratory High School closed its doors in 1969. An elementary school that had been established on the campus of the college succumbed in 1971. The various reasons for the decline of lab schools and the ramifications of school closures are discussed in the following section.

The Decline of Lab Schools

Reasons. Despite the myriad benefits to teacher education that lab schools provided, they were faced with numerous challenges, which ultimately lead to the shuttering of the majority of schools. One of the key reasons for this decline was high turnover due to low teacher pay (Gresham, 2012; Harms & DePencier, 1996; Ohles, 1961). Another key reason was that there was a diversity of purposes within each school. This lead to a disconnect between the teachers' classroom responsibilities and the role of teacher as researcher (Ohles, 1961; Kochan, 1997; Perrillo, 2016).

By the early 1960s the handwriting was on the wall for the laboratory school. John Ohles (1961) penned an article in the *Journal of Teacher Education* enumerating the problems facing lab schools. Among these reasons he cited specific "'critical problems': 1) expanding demands; 2) rising costs; 3) increasing pressures on personnel; and 4) integration of the professional laboratory experiences with the total college program" (p. 390). More specifically, Ohles expressed concerns about the nature of experimental activities in classrooms with real children where the teaching practices were "inappropriate" or "questionable" (p. 391). In addition, the aim of the university was to prepare their own students and this was often at odds with the preparation of the children in the model classrooms. In other words, the goals of the university did not always match the needs of the school. The lab schools were often too small to sustain the academic and financial pressures placed on them and this in turn, hampered the education of the pre-service teachers. (Ohles, 1961; Snelgrove, 2007;

Thomas, 1956). According to Ohles (1961), the burdens placed on both laboratory teachers and college faculty were too much. For example,

> In addition to teaching, the laboratory teacher must supervise student teachers; prepare, conduct, and evaluate demonstration lessons; engage in experimentation; meet with parents, with visiting teachers, and with college instructors. As a member of the college faculty, the supervisor is expected to serve on committees, engage in professional activities, be a consultant, and participate in community activities. College faculty members are also expected to pursue the highest academic degrees and write for publication (p. 392).

These numerous responsibilities made it difficult for lab schools to find and retain qualified individuals (Gresham, 2012; Ohles, 1961). In addition, there were problems with maintaining consistent administrators in lab schools (Perrillo, 2016; Ohles, 1961; Snelgrove, 2007).

Ramifications. As the laboratory schools began to struggle, colleges of education began moving away from the lab school in favor of placing pre-service teachers in local public schools for their clinical experiences. In the case of the University of Oklahoma system of lab schools, this was a common occurrence that likely resulted from the fact that there existed a distinct separation between the lab schools and the college faculty. According to Snelgrove (2007), "this was is not a separation in spatial terms but in terms of interest and ownership unless one of the students is a child of the faculty member" (p. 164). The concept envisioned by Dewey that the lab school would be place to conduct research was not adopted by all lab schools. Rather, many lab schools were criticized because the schools were a place for educating the faculty's children and not necessarily a place for teacher training and research (Abrahams, 2011; Darling-Hammond, 2006; Glennon, et al., 2013). This is, perhaps, one of the reasons that many lab schools closed their doors. Without a strong commitment to teaching pre-service teachers and creating new knowledge for the field, it was easy for schools to cave under the financial pressures.

There were two key results of the decline in lab schools. The first was the search for alternatives to the pre-service teaching clinical experience. Colleges of education began making it a common practice to place pre-service teachers in local schools, often offering a small stipend to teachers willing to work with them (Glennon, et al., 2013). Another idea was for local teachers to use televisions to broadcast their lessons to the university classroom for education students to observe and analyze (Ohles, 1961). The second result of the decline of the lab schools was the transformation of the schools from university-affiliated institutions to private, tuition-based schools. This is the current situation of most lab schools today.

Present: Lab Schools Today

Currently there are more than sixty but fewer than 100 laboratory schools in operation globally (Sparks, 2015; Weih & Ensworth, 2006). The fate that befell the University of Chicago's Laboratory Schools seems to be the common thread among many schools. Saved by parents and strong community ties, these schools are now tuition-based, private schools or public charter schools (Gresham, 2012; Sparks, 2015). Those that are still tied to a university system serve mainly the children of faculty along with a few local children. What makes them "lab schools" is their commitment to Dewey's philosophy of child-centered learning and best practices.

While the majority of lab schools fit the description above, there are still some schools in existence that meet the true definition of lab schools and endeavor to focus on researching how children should be educated, providing solid educational foundations for children, experimenting with new ideas, offering professional development, developing curriculum, and serving to train pre-service teachers (Weih & Ensworth, 2006; Wilcox-Herzog & McLaren, 2006). For example, Weih and Ensworth studied the impact of this lab school structure on students in an education course at a large Midwestern university. Students in an elementary curriculum class at the university worked with students in grades K-5 to develop a unit based on non-fiction literature. The pre-service teachers were responsible for selecting the materials and teaching them to the students in the university's lab school. After the lesson, a survey was given to the pre-service teachers, the classroom teachers, and the children to determine their perceptions of this experience. The pre-service teachers felt that their teaching abilities were enriched and enhanced by being able to interact with the children. The classroom teachers benefitted from the implementation of new ideas and the chance to reflect on their own teaching. Finally, the children who were taught enjoyed the lesson and benefitted from the exposure to different styles of teaching.

Abrahams (2011) also highlighted the experience of a current lab school in his study of pre-service music teachers in New Jersey. These teachers worked with the lab school during their methods courses to develop lessons and learn how to implement them. According to Abrahams,

> this approach provides opportunities for the preservice music education students to observe the strengths and weaknesses of the lesson they have written. Consistent with its mission, the partnership also provides the lab school instructor the opportunity to learn new strategies presented to the preservice college students by their college instructor (p. 111).

The previous two research scenarios illustrate the way the lab school model has changed since its inception. The mission today is one of give and take between the pre-service teachers and the classroom teachers, while the model of the past saw the lab school classroom teachers as the experts in charge of conducting experiments, writing textbooks, and developing curriculum.

The current model of lab schools is an attractive educational opportunity for many parents. There are several benefits to lab schools. For example, the teacher to student ratio is typically quite low (Erickson, Gray, Wesley, & Dunagan, 2012). In addition, many schools house an entire K-12 student population, offering more structure and continuity. Perhaps the greatest benefit offered in today's lab schools is the collaboration between the lab school and a university, which "offers an atmosphere that promotes student interest in higher education" (Erickson et al., 2012, p. 1). On the other hand, this key benefit to the lab schools can also be one of its greatest detractors. The constant flow of people in and out of the classroom can be a disruption to students. Other drawbacks to the lab school environment include the homogeneity of the student body, not to mention the high cost of tuition (Erickson et al., 2012).

Notable Institutions

Bank Street. In her book, *Powerful Teacher Education*, Linda Darling-Hammond (2006) provides a portrait of the Bank Street College lab school, one of the few remaining lab schools with strong ties to a university. Although relying on private school tuition, the lab school works "as an adjunct of the college and a site for demonstration of progressive child-centered practice and a training ground for teachers" (p. 162). The School for Children is situated on the campus of Bank Street College in a seven-story building and is staffed by graduates of the college. Approximately 80 student teachers work in the school annually. Both undergraduate and graduate students regularly observe the goings on in the school, as well as work as interns. "The work of the school and the college are closely interrelated" (p. 165). The lab school serves as a model for teacher preparation and receives many visitors from around the world, just like at the University of Chicago's Laboratory School did decades ago. The relationship between the teacher education program and the school itself is lauded because pre-service teachers can "spend significant time learning to teach in an environment that models teaching for understanding coupled with intense consideration of the learning approaches of different children" (p. 167).

P.K. Younge. In an article in *Education Week*, Sarah Sparks (2015), discusses the plight of several former and current laboratory schools. One in particular receives much attention. At over 80 years old, P.K. Younge lab school in Gainesville, Florida had a rich tradition of providing training for pre-service teachers at the University of Florida. After dealing with financial struggles in the throughout the 1990s, the school was designated a public school of choice so that it would continue to receive funding from the state. Holding to the true spirit of Dewey's lab school philosophy, the school is dedicated to research. Sparks wrote,

> P.K. Younge teachers, alone or in collaboration, conduct their own studies each year and present them to local researchers in an annual symposium, intended to launch larger research projects. The classes are open to observation, and the school helps train education researchers on how to study in schools without interfering with students in classrooms (p. 12).

With state funding and additional income coming through professional development workshops, P.K. Younge is thriving. While the spirit of the school is in keeping with traditional lab schools, its independent nature and lack of university funding makes it part of a new breed of lab schools for the 21st century.

Possibility: Establishing a new Lab School

The International Association of Laboratory Schools was established over fifty years ago with the intent of offering support for lab schools around the world.

Formerly the National Association of Laboratory Schools, the organization recognizes that lab schools have changed over the years and is dedicated to recognizing the necessity of the lab school to meet the needs of an increasingly diverse teacher population and "improving the science and art of teaching" (IALS, 2016). The mission of lab schools in the 21st century should be to create academically strong programs for their students, actively engage in the training of teachers, and work toward a clarification of educational issues in order to benefit the entire field (Darling-Hammond, 1997; Kochan, 1997).

Funding and Organization

According to the director of the International Association of Laboratory Schools, there have been several recent requests from colleges for more information about establishing a laboratory school (Sparks, 2015). With funding being the biggest challenge to creating a lab school, universities investigating this possibility need to understand that the school would have to be a private, tuition-based institution or a state funded charter school. This often goes against the public school philosophy of many colleges of education. Another option is to apply for federal or state grants. For example, the former governor of Virginia, Bob McDonnell, investigated the possibility of funding new lab schools at the state's public universities.

Funding is the biggest concern for the efficient operation of all schools, however lab schools have historically proven to have more funding problems than other schools. A clear understanding of these funding issues is imperative before undertaking the task of opening a lab school. Gresham (2012) researched the organizational and financial practices of two successful lab schools in an effort to shed some light on how they have remained in operation. She studied 87 years worth of school records, as well as interviewed administrators, teachers, and parents. She was able to identify three crucial organizational practices: "(a) creatively utilize state funding and regular student tuition to assist with lab schools' support; (b) institute childcare tuition to help cover costs; (c) use teacher candidate lab fees and include lab school teachers as university faculty" (p. 3). She asserts that with continued commitment to the practice of clinical teacher preparation coupled with an ability to use creative funding, the schools were able to remain open and thrive.

Regardless of the source of funding, it is imperative that there be a clear plan when considering the possibility of establishing a new lab school. Wilcox-Herzog and McLaren (2012) identified eight necessary components of a successful laboratory school:

> 1) provide a clear mission statement; 2) define the curricular program; 3) secure various streams of funding; 4) build relationships through networking; 5) balance the historic tripartite mission – observation, practicum, and internship; 6) develop links with academic programs on campus; 7) provide adequate, well furnished space; and 8) consider leadership carefully (p. 5-6).

Given these requirements, the goal of establishing a new laboratory school seems insurmountable, yet these two educators were successful in opening a small school on the campus of their own university in California.

Erickson et al. (2012) conducted a survey of parent opinions regarding their experiences with children currently enrolled in lab schools. The findings of this survey add to the advice for prospective universities considering a lab school. Their recommendations include:

> 1) …research the benefits of academic reputation, small school size, impact of no transitions between schools, high-quality teachers, and beginning college matriculation early. 2) …monitoring the actual performance of teachers and administrators and comparing them to a baseline standard such as a national and/or regional accrediting agency… and make clear that personal opinions should not guide instruction. 3) … student access to rigorous courses must be insured to accommodate the expectations of parents and insure, where appropriate, a high score for the ACT and/or SAT with the potential of scholarship opportunities (p. 7).

While there are many challenges present when establishing a lab school, the preceding information regarding funding and organization, serves to provide a rough outline, or blueprint, for how to proceed.

Education Reform

John Goodlad (1997) has suggested that the lab school model be reinvigorated in order to address education reform in the United States. The key to doing this lies in the mission of the school itself. It needs to be determined if the school will be used for teacher training or for teacher research. Combining both goals has caused problems with schools in the past and likely precipitated the closure of several schools. Goodlad does not believe that "a laboratory school in a heavily research oriented university and a laboratory school in a heavily teacher preparing university should necessarily perform the same function" (p. 1).

In order to lead the movement in education reform, lab schools should be working in conjunction with universities to experiment with new ideas. As in the past, these ideas can be implemented quicker in the lab schools than in public schools (Goodlad, 1997; Kochan, 1997). Subsequently, the new ideas can be tested, perfected, and then shared with the education community at large. In doing so, "laboratory schools should become more visible and vocal about their strengths and the contributions they can make to school improvement and educational reform" (Kochan, 1997, p. 16).

Conclusion

The first lab school was established in 1896 by John Dewey with the intention of studying children in a progressive, child-centered learning environment. Over the ensuing years, several other notable lab schools were founded, such as the Lincoln School at Columbia University. After decades of struggle with finances and teacher attrition, the majority of lab schools in the United States closed their doors. Today there are still scores of lab schools, some of which still adhere to Dewey's philosophy. Most notable is the School for Children, which supports the training of pre-service teachers at Bank Street College in New York. These schools are supported in a multitude of ways: tuition, state funding, university funding, and even generous donors. For those universities that are considering the establishment of their own lab school, it is necessary to have a clear understanding of these sources of funding. Finally, a commitment to either teacher education or research is vital for the ongoing success of these institutions.

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Toddlers Can Enjoy Food Preparation and Cooking: Connecting Food Activities with Reading Children's Books

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"I don't like these, and I want more!" "I don't like it, too!" "I am not fond of this!" "I yike it! Give it to me!" These comments were made by toddlers when they tasted different kinds of fruit during a classroom 'tasting party' at one laboratory school. This 'tasting party' was facilitated by teachers, and during the party the teachers and toddlers tasted different kinds of tropical fruits, including papayas, pineapples, mangos, bananas, and coconuts.

Children live in a world that offers a variety of food options. Because toddlers and children learn eating habits while young, developing healthy eating habits early in childhood places them on a path to more nutritious food choices later in life (Birch & Anzman, 2010; Gonzalez-Mena, 2012; Izumi-Taylor & Rike, 2011; Kalich et al., 2014; Sigman-Grant et al., 2014). Given this connection between early food experiences and healthy eating, it is important that family members and early childhood teachers provide toddlers with ample opportunities to experience a variety of healthy foods (Kalich et al., 2014) and cultivate healthy eating habits. One way to do this is to engage toddlers in fun cooking activities either at home or in the classroom.

Young children, including toddlers aged 16-36 months, can learn to cook with a little help from their family members and teachers. In practice, cooking with toddlers can be understandably difficult to undertake, as parents often are pressed for time around mealtimes (reviewed in Jones, 2018) and many teachers avoid cooking activities because they are messy (Izumi-Taylor & Morris, 2007). However, due to the many potential benefits of engaging toddlers in cooking, taking the effort to do so may be worthwhile (Izumi-Taylor & Rike, 2011; Matricardi & McLarty, 2005). Additionally, through engaging in developmentally appropriate cooking activities, toddlers can experience a joy of cooking, a sense of accomplishment, and a pleasure of tasting food from different cultures (Taylor & Dodd, 1999; Izumi-Taylor & Rike, 2011). And in the end, toddlers can enjoy the final products of their work (Izumi-Taylor & Morris, 2007; Izumi-Taylor & Rike, 2011).

The organization of this article is as follows. We first briefly review the benefits of engaging young children in cooking activities. We next describe some simple cooking approaches and activities that teachers and family members can implement in toddler classrooms and at home. The activities we describe in this article specifically draw inspiration from children's books; we show ways in which teachers and family members can first read a children's book, and then lead a fun cooking or eating activity that connects with topics or examples from the book. Finally, we provide simple recipes, a short list of some children's books involving food and cooking, and helpful websites for teachers and other helping adults, so that others may try similar approaches at home or in their classrooms. Additionally, we will include children's comments and teachers' suggestions regarding these cooking activities that were implemented at one laboratory school.

Benefits of Engaging Children in Cooking and Food Preparation Activities

In this section, we describe some known or suggested benefits of engaging children in cooking or food preparation activities. These benefits (reviewed more extensively by Colker 2005, and Izumi-Taylor & Dodd, 1999) include developing healthy eating habits, and constructing key forms of knowledge through the multisensory experiences, observations, and social interactions involved when preparing food.

One potential major benefit of engaging children in cooking is cultivating healthy eating habits (Matricardi & McLarty, 2005). For example, a recent experimental study found that older children (six to 10 year olds) who cooked together with a parent ate more salad, more chicken, and consumed more overall calories during the meal than children who were near their parent during meal preparations but did not help (van der Horst et al., 2014). Furthermore, the children who cooked reported immediate beneficial emotional impacts and showed more interest in cooking at home after the study, suggesting that a single cooking session can have positive impacts for the child during the meal and extending over the longer term (van der Horst et al., 2014).

This link between cooking with children and their development of eating habits may extend to young children including toddlers as well (Izumi-Taylor & Rike, 2011). Encouraging preschool-aged children to help with preparing vegetables is a component of one effective parenting practice that is associated with increased vegetable consumption (Baranowski et al., 2013; O'Connor et al., 2010). Specifically, having children help with food preparation is considered to be a use of 'teachable moments" practices, which are practices frequently used by parents of children who eat more fruits and vegetables (O'Connor et al., 2010). It has also been hypothesized that cooking activities with two-year olds might promote healthy eating habits by reducing food neophobia; this is being investigated in a current study (Helland et al., 2016).

In general, current health risks, including obesity, have caused early childhood educators, parents, and family members to reflect on providing toddlers with healthy food choices (Gooze et al., 2010; Izumi-Taylor & Rike, 2011; Koralek, 2014). When adults model their appreciation and enjoyment of diverse and healthy food (Kalich et al., 2014; Marotz et al., 2005), it influences children's thoughts and behaviors about different tastes. Despite these ideas, there is a pressing need for more research on the impacts of cooking initiatives on children's eating habits, both for school-based (Caraher et al., 2010) and home-based cooking initiatives.

Another major benefit of engaging toddlers in food preparation and cooking is developing various forms of knowledge including physical, logico-mathematical, and social (as described by Kamii and DeVries 1982). Toddlers can develop *physical knowledge* by learning physical attributes of food such as hard, soft, smooth, etc. (Taylor & Dodd, 1999). When toddlers wash and taste celery, they experience firsthand the hard, crisp, and crunchy aspects of the vegetable. Importantly, food preparation cooking activities provide multi-sensory experiences as toddlers use their five senses to touch, smell, taste, see, and hear food (Colker, 2005; Everson, n.d.). Toddlers observe *logico-mathematical knowledge* by measuring amounts, combining ingredients and observing and describing changes to food as it cooks. For example, toddlers can be guided to observe how an apple, when cut by an adult supervisor, transforms into many pieces that are differently shaped. Finally, teachers can promote toddlers' *social knowledge* by discussing food names, procedures used in preparation and in dining, safety during preparation and cooking, and cultural traditions in food preparation. There are other proposed benefits of engaging young children in cooking, such as the development of fine motor skills and socioemotional skills such as confidence (Colker, 2005).

Preparations and Considerations When Cooking With Toddlers

While preparing to engage toddlers in cooking activities, teachers and family members should first consider important issues related to food preparation. Before starting any cooking activity, teachers need to inform children's families in order to communicate about the activity and learn each child's food allergies and dietary restrictions. Any adults involved in the cooking activity should be aware of these food allergies and dietary restrictions, and should take appropriate precautions. Involving and informing families about cooking activities can furthermore promote toddlers' healthy food choices and might support children's efforts in trying new food (Byington et al., 2014; Kalich et al., 2014). Since culture plays an important role in diet, teachers should also invite dialogue about relevant family attitudes, values, and home or cultural approaches involved in feeding young children (Branscombe & Goble, 2008). It also may be important to know that toddlers begin to eat less when their growth rate slows during the first 18 to 36 months (Aronson, 2002).

During the food preparation and cooking process, teachers and other helping adults must enforce effective and safe practices (Matricardi & McLarty, 2005). They should remind toddlers that they need to wash their hands before touching any food or supplies, and carefully emphasize and adhere to any safety precautions. They should also determine and provide developmentally appropriate tools and ingredients. Finally, during any food or cooking activity, it is essential to monitor toddlers at all times. For a more comprehensive list of safety considerations while cooking with young children, refer to Colker (2005) and Matricardi and McLarty (2005).

In addition to maintaining safe practices and procedures, teachers should understand toddlers' developmental task levels and plan accordingly. One way to introduce cooking in classroom contexts is by setting up a snack center (Colker, 2005; Parlakian & Lerner, 2007). Teachers can provide regular snack times (Izumi-Taylor & Rike, 2011; Parlakian & Lerner, 2007) and offer snacks children can make themselves. For instance, pouring their own juice and spreading cream cheese on crackers are ways some toddlers may participate in food preparation. At this laboratory school teachers talked about self-help skills to toddlers and told the children that they could pour their own juice into cups and spread cream cheese on crackers by themselves, but also the teachers told them that if they felt uncomfortable doing these tasks, they could ask for help. Many children were excited to try their snack preparation tasks.

Introducing Cooking Activities with Toddlers Using Connections to Children's Literature

In this section, we present ways to introduce cooking activities to toddlers using ideas and inspiration from children's books involving cooking and food (Colker 2005; Izumi-Taylor & Morris, 2007; Izumi-Taylor & Rike, 2011). Since children enjoy books and stories, teachers and other helping adults can read to children books about food and offer related cooking activities to more effectively engage students in the activity and to draw fun connections. We provide three approaches that teachers and family members can use, which vary from low to greater complexity. For each approach, we include observations and comments from toddler classrooms at one laboratory school.

Approach 1: Tasting Foods from Children's Books

At this laboratory school toddlers engage in cooking activities at least once a month. Children and teachers read a book and then taste or sample foods that are present or discussed in the book. A teacher read a book entitled *The carrot seed* (Krauss, 1973) to toddlers. After reading, she said to the children, "Today, we are going to taste carrots. I know some of you do not like carrots, but we are going to at least try them. After tasting, we will go outside and plant our carrot seeds in our garden." There were many conversations around this classroom before and after tasting carrots. One child cried, "I am not going to taste it, I hate carrots!!" Another child said, "I am gonna eat it so I can be like a bunny!" Although some children did not enjoy tasting carrots, they enjoyed planting them in the garden.

In general, many books children's books include images or descriptions of foods, including books that are not specifically about food or cooking. While reading these books, take note of the foods present and recognize this as a fun opportunity to engage toddlers in tasting those specific foods.

Approach 2: Preparing Snacks Inspired by Literature

A second approach is to read a book to children and then prepare simple snacks that are inspired by the book. Often, these snacks will involve handling and mixing foods, but do not necessarily involve cooking. At this laboratory school, a teacher of toddlers read Eric Carle's *The Very Hungry Caterpillar* (1987) and let children spread cream cheese on crackers and design a caterpillar on a lettuce leaf (Izumi-Taylor & Rike, 2011). The children called them *Caterpillar crackers*. While making and eating his crackers, Shareef said, "Mmmm… I am a hungry caterpillar and I can eat many caterpillar crackers!!"

There are many other foods toddlers can prepare that require no recipes or complex cooking procedures. They mix and create their own trail mix using all sorts of combinations of crackers, cereals, and dried fruits. Toddlers like to participate in mixing the ingredients, and identifying each item. When children mix, spread and scoop ingredients, they develop small motor skills and enhance coordination. Taking part in food preparation exercises their brains as they encounter new foods, solve problems, process language while following directions, and engage in pretend play that can stretch their imaginations (Izumi-Taylor & Rike, 2011).

Approach 3: Following a Recipe

A third and the most complex approach is to read a book to children and then prepare a cooked meal or food type that is described in the book. When cooking, it is especially important to monitor children at all times and ensure their safety with hot foods and surfaces (Matricardi & McLarty, 2005).

To illustrate this approach, older toddlers at this laboratory school have enjoyed cooking pancakes. Teachers and children have been reading a wordless book, *Pancakes for breakfast* by dePaola (1978) for three weeks at the children's requests. The children and teachers talked about this cooking activity, and one child said "I want pancakes because I never had them before. What do they taste like?" Based on this child's question, the teachers and children decided to cook pancakes.

Before cooking, the children and teachers talked about the importance of being careful since they will use a griddle. First, the teachers introduced the children to the simple pictorial recipe of whole wheat pancakes, ingredients, and cooking utensils including a griddle. They showed the children how each of them can measure a single portion of pancakes as well as how to stir them. The teachers also informed the children that if they were uncomfortable doing this cooking activity, the teachers could measure and mix their portions for them.

Then, they began preparations for cooking. In order to cook their pancakes, the teachers made a copy of the pancake recipe described by Anfin, Norton, and Anfin (1997), laminated it, and then placed it on the table so the children and teachers could all see it. After the children washed their hands, the teachers introduced the children to the utensils that included a griddle, spatula, plate, and spoon. Then the children and teachers gathered in small groups and measured the ingredients in one big mixing bowl. The children and teachers blended the mix, and then the teachers showed the children the oil used to cook the pancakes as well as toppings such as butter, syrup, and honey. When they started cooking pancakes on the griddle, the teachers told the children that when their pancakes started to bubble, it would be time to turn them over. The children were amazed at the bubbles, and one child exclaimed, "Wow! I made bubbles, and I can eat this!" Another child wanted to turn her pancake over but realized that it was hot and told her teacher, "I am not touching it. It is too hot; you turn it!" The teachers explained to the children that they could choose the toppings they wanted to put on their pancakes. Because they had already sampled the different toppings, the children were able to choose them easily. Some children enjoyed honey more than butter, while others preferred syrup**.** The above example of children cooking pancakes illustrates one specific cooking example. Teachers and other helping adults can also provide children with pictorial recipes that specifically inform children about the sequencing of cooking. Cooking books such as *Cooking with mother goose* (Anfin, Norton, & Anfin, 1997), *Cooking activities A to Z* (Matricardi & McLarty, 2005), and *Cook and learn* (Veitch & Harms, 1981) are helpful because they offer easy-to-follow pictorial recipes. When cooking, teachers and family members need to identify and model each item to help children understand what they need to do.

Another activity that children enjoy at this laboratory school is cooking a 'magical' pumpkin soup after reading the book entitled *Pumpkin soup* (1998) by Helen Cooper. In this classroom, as the children watched at the table, the teacher informed them that she needed to warm the oven to 400 degrees before cooking. Then she cut around the stem to make a lid on the 3 to 4-pound pumpkin. The children helped their teacher scoop out the seeds, and then the teacher placed the pumpkin on a shallow pan and added the following ingredients with help from the children: one tablespoon of dried thyme (optional), three cups of chicken or vegetable stock, and 1/3 cup grated parmesan cheese. When preparing the pumpkin, the children could help scoop out the flesh, measure and pour the stock into the pumpkin, and add the prepared ingredients. The teacher informed the children that she would replace the lid and bake the pumpkin for two hours. To serve, the teacher scooped out the soup and placed it in each individual soup bowl. If the children wanted to, they could top their soup with more cheese to enhance the flavor.

The children enjoyed this activity because they were able to see the whole pumpkin being cooked in the oven. After the pumpkin had been cooked and removed from the oven, they could see that it had retained its original form. One child said, "This is a magic pumpkin!" and another one cried out, "This is for Cinderella!"

Summary

Preparing foods with toddlers provides a fun and engaging approach for promoting healthy eating habits and development. Toddlers can experience these benefits when teachers and family members read books involving food and then provide the toddlers with fun tasting, snack preparation, or cooking activities that creatively connect in some way to the book. By doing this, children experience healthy food in encouraging settings, fun in trying and making food, and an early and healthy start toward establishing healthy eating habits.

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Helpful Websites for Teachers and Other Helping Adults

- American Academy of Pediatric(s) includes useful information on parenting, health-related topics, and professional education and resources. http://www.aap.org
- Booklet on healthy eating for children from infancy to age three: "Healthy From the Start" offers information on how to feed and nurture young children's bodies and minds: https://www.zerotothree.org/resources/352-healthy-from-the-start
- Healthy Child Care America's website presents helpful topics to health care professionals, childcare and early childhood education professionals, and families with children. http://healthychildcare.org
- The Association of Maternal & Child Health Programs supports women and children in their health-related issues by providing national leadership. http://www.amchp.org/programsandtopics/CHILD-HEALTH/resources/Pages/default.aspx
- The National Association for the Education of Young Children (NAEYC) provides innovative free resources regarding health and nutrition for children birth to age eight. https://www.naeyc.org/resources/topics/nutrition
- This website is to ensure children's health, education, and safety. It also aims to help children' families as well. http://www.childrensdefense.org

Author's Biographies

Satomi Izumi-Taylor, Ph.D. is Professor Emeritus with the Department of Instruction and Curriculum Leadership at the University of Memphis, Tennessee. Her research interests include cross-cultural studies of teacher education, play, constructivism, infant and toddler development, and science education.

Katie E. Boes, Ph.D. is Health Professions Advisor at The College of Wooster in Ohio. Her research interests include behavioral ecology and science education, and she advises undergraduate students. As a relatively new Mom, she greatly enjoys cooking together with her kids.

Carol Cordeau Young is a Supervising Teacher at the University of Memphis Early Learning and Research Center. In her 2 year-old classroom, her research interests include cooking with young children, tea party behavior and project based curriculum as it relates to STEM explorations.

Ariel Laws is a Doctoral Student at the University of Memphis and Preschool Teacher. Her research interests include mindfulness, children in poverty, and literacy development.

Retirement is weird! A Reflection from senior IALS member, Sandra Brown Turner

Sandra Brown Turner
UNIVERSITY OF MEMPHIS

In May, 2018, I found myself asking, how does one retire from her life's work, her 'calling'? Am I still me, an educator, leader, contributing member to my field? What do I do with all this experience, knowledge, wisdom? How can I still be helpful? Cognitively I know how to reconstruct my energies into worthy endeavors in the community and the country. The problem is the process, just like in early childhood practice, and we've said it for years, "It's the process, not the product."

I came into the field of Child Development/Early Childhood Education when it was emerging as a legitimate field of study in the 1960's at Memphis State University (now the University of Memphis). Before that time most children remained at home with mothers or extended families or other caregivers. In Europe, Dr. Jean Piaget, was studying his own children, and that extrapolated into an international bona fide "field of study." Of course before him, there was Fredrick Froebel, the Father of Kindergarten; Vgotsky, the social learning theorist in Russia; and John Dewey, putting forth a progressive idea that education in the U.S. should start with the very young, and these are only a few of the early pioneers. But Piaget introduced the notion of observation, documentation and experiential cognitive learning. Since then, multiple theorists have contributed to what we now know as Early Childhood Education. They taught us that children are born learning; they didn't wait until kindergarten or first grade. I've spent my lifetime learning about and with young children in a variety of classrooms, at camps, in the community, and in neighborhoods, around the nation.

I have been an active member of NAEYC since 1975; I served on the original Accreditation Commission as President of my local MAEYC affiliate and on the Executive Board of the state of Tennessee AEYC, and I was an accreditation validator for 15 years. I additionally published several articles and books. In other words, while deeply ingrained in the work of doing the right things for young children, *I grew* as the *field grew.*

Today I continue to serve on the Board of Directors for the International Association for Laboratory Schools and have served as the IALS President. Laboratory schools are the foundation for so much solid research, innovative teaching and learning, and the professional development of teachers. So now that I am no longer in a seat of responsibility making decisions on behalf of teachers and children, what will my next steps be since my mind, my heart and my spirit failed to retire with the position?

Well, I've always been a fairly good writer, so I started to write. I wrote letters to people with whom I'd shared a career. I wrote letters of recommendation for former students. I wrote poems to my loved ones. I wrote an outline for a book which I continue to work on. I co-authored several articles with former colleagues. And now, I write this reflection of my personal journey. While it is an exercise in self-awareness for me, I have gained some insights, some knowledge, and some wisdom to share.

Being an academician, I searched for information about how to retire. I spoke with other retired educators who gave varied advice. Some said, "Just relax!" Others gave a health report. But I found a gem in the book, *How to Retire Happy, Wild, and Free* by Ernie J. Zelinski. It is retirement wisdom that is not framed by a financial advisor. He explores retirement in a very humorous, yet mindful way. I found the section "Activities with a Major Purpose" very helpful, especially the "Get-a-Life Tree." It appealed to my curriculum webbing knowledge. Four options for retirement are grouped into 1.)New activities I have thought of doing, 2.) Activities that turn me on now 3.) Activities that turn me on in the past, and 4.) Activities that will get me physically fit. I am having a lot of fun working those out, except for the physically fit one. Aging is truly a physical bugger no matter how young you are in your head. But I ascribe to the belief that we are triune beings – Body, Mind, Spirit – so, I try to balance all three. Some days are better than others.

Recently, I also read a very nuts-and-bolts article titled, "Countdown to Retirement" in the Feb/Mar 2019 issue of the *AARP Magazine* (aarp.org/magazine). If you are considering retirement in 1-5 years, this article could be your roadmap. As with all big tasks in life, retirement is best done in small steps over a period of time. I am happy that although I did not have this article while preparing to retire, I have not made too many errors in getting there. Another little gem I discovered is the book, *Life Reimagined: The Science, Art, and Opportunity of Midlife*, by Barbara Bradley Hagerty. Although retirement is a little past the midlife marker, to reimagine one's life is the challenge. The last chapter, "The Meaning of Work," Hagerty labels retirement as "…the existential necessity of change." By examining our work lives, and all we did in those lives, she encourages a "…return to essence." She gives retirees permission to have new ideas to pursue, and she encourages them to give life to some dreams that were previously laid aside during our working years. I found her writing extremely edifying!

First, retirement comes very quickly! I have no idea where the last 50 years have gone. I thought I planned for it. As it turns out, I did great with the financial part, but the mind/body/spirit part of retirement was always framed as "some day." I always put in 100%, or close to it, each day. I enjoyed each day. I contributed to my field as a local, state, and national leader. I thought I had defined myself truly and deeply without the context of my work. To some extent I had done that. But when I painstakingly made the decision to retire, I was quite terrified. Of course, the aspect of aging was something I intended to ignore in order to "grow old gracefully," but this luxury is not necessarily allowed in our society. All of a sudden it seemed I was just plain old me.

Secondly, I had to be patient with myself. Some mornings I simply stayed in bed with a good book. I cooked and ate good food that I enjoyed; I did not diet. I did not release my restlessness in exercise. I puttered around the house filling boxes with stuff for Goodwill. That was cathartic. I went to movies in the middle of the day. My husband and I vacationed at the beach with our adult children and grandchild, and my sister's family. We drove from Memphis up to Washington D.C. where our children and grandson live. We spent the whole month of July soaking up new adventures in the D.C. area. We spent unrestricted time at our cottage in the Ozark Mountains. After all, I didn't have to show up anywhere anymore. The most annoying test of my self-patience was the Medicare, medical supplement, prescription drug plan decisions. That arduous ordeal made me feel very inefficient. But I learned perseverance is the name of that game. So, once I got my solid footing (with the excellent expertise of my husband who retired from the Area Agency on Aging as their Medicare expert) and after the newness of retirement wore off, I began to re-imagine where I wanted to put my energies, knowledge, wisdom.

My next realization was that once you're done, you're done. You don't have to show up anymore. I tell myself, "Not my circus, not my dancing bears anymore." Therein lies the freedom. What used to matter so much is not so important anymore. I've realized the power of decision-making is somewhat imaginary and negotiable. In retirement I get to decide what has power in my life and what does not. Of course I have always had cognition of this truth but when 'the whole world' is not at stake, I can see clearly what is dross and what is life-supporting. I am also satisfied knowing that not everyone will understand my retirement journey; because it is not anyone's journey but my own.

At this point, some months into this experiment, I am finding myself not so spread out in my endeavors. I am delighted to be a grandmother to our grandson, Hugo, and a great aunt/grandmother to three great nieces, Ella, Anna, and Kate, and to three heart-adopted grandchildren, Orlando, Michael, Angelina, who all call me Ninny, a very fitting name for me and my sense of humor. I was asked to continue to serve on the International Association of Laboratory Schools Board which I graciously accepted. I have become a volunteer at LeBonheur Children's Hospital where I costume myself into The Fairy Godmother and read books or just sprinkle magic dust on children who are hoping to get well. I am more active in some organizations that are working on gun violence – Moms Demand Action, Everytown, and Sandy Hook Promise. The Sandy Hook School violence happened on my 61st birthday, and my heart has kept my grief about that horror to this day. Another freedom retirement allows is that I can be open to other endeavors that interest me; but I get to choose. Being a Memphis native, I am ingrained in the social justice action here. We are charter members of the National Civil Rights Museum, and I am still called on to assist in creating curriculum for visiting children. I have all the growing up memories of discrimination, racism, and Dr. King's assassination here, and the tough work since then to bring about equality. I am politically active locally, and I make my voice heard at the national level to my representatives in Congress. And yes, I march and protest and resist what is harmful to WE THE PEOPLE.

Which brings me to an actualization about myself; I am authentically me, no matter what I do or where I go. I am a woman, a mother, a wife of 48 years, a grandmother, a sister, an aunt, a surrogate mother for people I have chosen to be in my family, a friend. I walk my talk in my beliefs that I care about people and their lives. I desire to make my community, my country, my world a fitting place for all people, especially children and families to grow and prosper. My life continues to count on the side of what is right, decent, and honest. I am a woman of real substance – mind, body, soul, spirit. As the Pulitzer Prize-winning poet, Mary Oliver, wrote, "When it's over, I don't want to wonder if I have made of my life something particular, and real. I don't want to find myself sighing and frightened, or full of argument. I don't want to end up having simply visited the world." And I know for sure, it is most satisfying to be just plain old me. And I'm looking and listening for new opportunities to serve.

Author's Biography

Dr. Sandra Brown Turner is retired from the University of Memphis, Barbara K. Lipman Early Childhood School and Research Institute, where she worked from 2000-2018. She also served as an Associate Professor of Early Childhood Education at Shelby State Community College from 1988-2000.

Unlocking Potential, Changing Lives: The 2019 IALS Conference Proceedings at Texas Christian University, March 20-22, 2019

Dr. Marilyn Tolbert, Conference Chair
TEXAS CHRISTIAN UNIVERSITY

If a child cannot learn the way we teach, we need to teach the way they learn! This statement resonated throughout the IALS 2019 Conference. The conference was held at the Starpoint and KinderFrogs laboratory schools located on the campus of Texas Christian University in Fort Worth, Texas from March 20-22. The theme was *Unlocking Potential: Changing Lives, Keys for Teaching Diverse Learners.* Fifty-four people attended a range of presentations focused on teaching an increasingly diverse student population and fostering relationships with their families.

Michael Remus delivered the keynote address, "Accommodations and Modifications," to conference attendees Thursday evening. In addition, he offered an extended conference session about providing visual supports for students with Autism Spectrum Disorder. Mr. Remus has been a general education teacher, special education teacher, college instructor, special education director for a school district and a state special education director for the State of Kansas. Most of his professional career has been in the classroom and in training parents and educators on how special education works. Both sessions were well attended and thought provoking.

In addition to school visits at both of the Laboratory Schools as well as a visit to Alice Carlson Applied Learning Center, 30 conference sessions and the keynote address, attendees took advantage of opportunities to explore the historic Fort Worth Stockyards, Sundance square downtown and the cultural district.

Conference topics included "Who Holds the Keys? Unlocking Partnerships One Door at a Time," "Embracing Social Justice: Through Classroom Conversations that Engage and Challenge to Grow in the Experience for Others," "Partnership and Advocacy for Developmental Differences in an Early Childhood Lab School," "Every Learner is Unique: Meeting the Needs of Every Child in your Classroom," and a myriad of others to address the variety of needs of children in our classrooms.

Attendees included colleagues from Kilby Laboratory Schools from the University of North Alabama, Leet Center for Children and Families/Horace Mann from Northwest Missouri State, Children's School at Carnegie Mellon, and many others sharing and exchanging ideas throughout the conference.

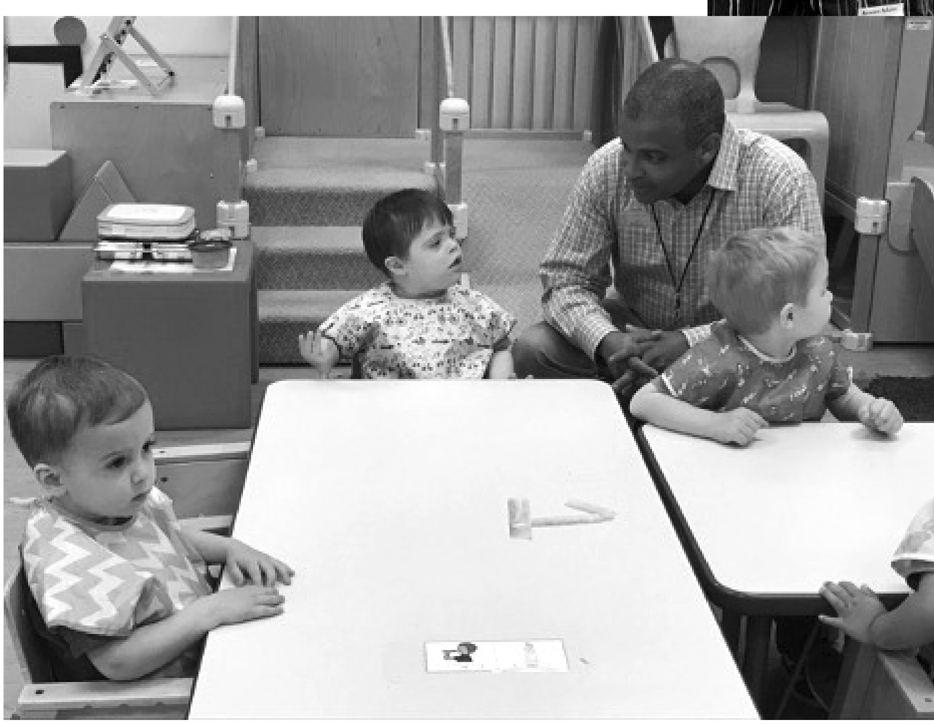
The strengths of IALS lie in our relationship building and in the exchanging of information and pedagogical practice. We worked with some of our colleagues to identify potential projects that we could post on the IALS website, and we invited other schools and teachers to participate in the conference with their classes from across the globe! We are looking forward to extending these opportunities in the coming years and we hope to see and we are looking forward to another fantastic conference!

Jean Bird, Konnie Serr, and Beth Myers ▸

▼ *Jill Sarada, Marilyn Tolbert, Richard Messina, and Christine Bogert*

▼ *Preschool Classroom at Lunchtime*

▲ *Kristen Adams and Patricia Diebold*



◀ *Luis Pino Rivera in the toddler classroom at snack time.*

LabSchoolsEurope: Participatory Research for Democratic Education

Dr. Christian Timo Zenke

We are very pleased to announce the start of the project "LabSchoolsEurope: Participatory Research for Democratic Education." Over the next years, a total of ten European institutions will be working together on questions of participatory school research and democratic education: Bielefeld University and Laborschule Bielefeld (Germany), École des hautes études en sciences sociales [School of Advanced Studies in the Social Sciences Paris] and Lab School Paris (France), University of Cambridge Primary School (England), Masaryk University and Labyrinth Laboratory School in Brno (Czech Republic), and University College of Teacher Education Vienna with its Primary School and Lower Second School for Pre-service Classroom Teaching (Austria).

LabSchoolsEurope is guided by the premise that there is a need for the development, evaluation, and implementation of innovative school concepts in multi-professional teams directly on site, focusing in particular on the question of heterogeneity mainly in the primary school sector.

The project encompasses six main objectives:

1. to develop and evaluate democratic pedagogical innovations for teaching in heterogeneous classroom settings at primary level (e.g. multilingual practice guides, teaching materials, and best-practice examples) and to make those available to a broader public,
2. to document and analyse the various research approaches and organisational framework conditions of the participating Laboratory Schools and to develop a comparative system of participatory school research,
3. to further train and professionalise the participating teachers and researchers with regard to research methodology and democratic education,
4. to sustainably improve schooling and teaching practices within the participating institutions from a democratic and pedagogical point of view,
5. to strengthen and consolidate the cooperation between respective schools and universities already practised at the various locations, and
6. to establish a European Lab-School network, closely linked with IALS, which promotes exchange among the participating institutions as well as with non-European partners and at the same time forms a starting point for the support of future lab-school foundations.

LabSchoolsEurope is an Erasmus+ project funded by the European Union (funding line "strategic partnerships in higher education") and runs from September 2019 until August 2022. At future conferences we will present the project as well as first results. In addition, a LabSchoolsEurope conference is planned to take place in Spring 2022 at one of the partner institutions.

(From left to right): Matthias Bischoff (Vienna), Christine Drah (Bielefeld), Oliver Wagner (Vienna), Sabine Jakl (Vienna), Kirsten Beadle (Bielefeld), Gabriele Kulhanek-Wehlend (Vienna), Monika Mandelíčková (Brno), Christian Timo Zenke (Bielefeld), Pavlína Loňková (Brno), Alexander Matthias (Bielefeld), Pauline Paquet (Paris), Jana Chocholatá (Brno), Benedict Kurz (Bielefeld), Pascale Haag (Paris), Gabriela Oaklandová (Brno), Caroline Nilles (Paris), Jan Wilhelm Dieckmann (Bielefeld), Gabrielle Allante (Paris), James Biddulph (Cambridge), Nicole Freke (Bielefeld). Not shown in this picture: Conny Hofmann (Bielefeld), Harald Knecht (Vienna), Marlène Martin (Paris), Bretislav Svozil (Brno), Annette Textor (Bielefeld).

INFORMATION FOR CONTRIBUTORS

Call for Papers—IALS Journal 2021

Information for Contributors

The *IALS Journal*, a refereed journal, publishes articles that contribute to the knowledge and understanding of laboratory and university affiliated schools and other significant educational issues. Most articles focus on research, innovation, or opinion. The subjects most often addressed are teaching techniques; administrative concerns; functions, history, and the future of laboratory schools; innovations in curriculum and program; teacher education; student growth and development; and philosophical topics. Rebuttals, responses, and book reviews are also considered for publication. We also welcome articles outlining innovative teaching practices in laboratory schools and columns celebrating exceptional laboratory schools or laboratory school educators. Unsolicited manuscripts are additionally encouraged for consideration, though preference is given to articles that link explicitly to laboratory schools. The Journal is published once a year.

Submission Requirements

Length

The maximum acceptance length is twenty-five pages, including all references and supplemental material.

Format

The *IALS Journal* uses the most recent edition of the American Psychological Association (APA) *Publications Manual*, for style format. It is vital that all manuscripts submitted for publication conform precisely to this APA style. In addition, manuscripts should be submitted as google docs. This allows for easy sharing with our reviewers.

Submission

Send your submission electronically to the editors of the journal at: srmortimore@ship.edu **AND** tesmithmoore@ship.edu. The electronic copy should be written in a **Google doc**. Submissions should **also include author's titles and affiliations, mailing addresses, and a 2-5 sentence author biography**. For consideration in the 2021 volume of the journal, please submit by **Oct. 30, 2020.**

Editing

The *IALS Journal* reserves the right to make editorial changes in all manuscripts to improve clarity, to conform to style, to correct grammar, and to meet space requirements. All submitted articles are reviewed by the Editors to determine acceptability for publication in the *IALS Journal*. During the revision phase, authors should include information concerning their title, position, laboratory school, university name, location, etc. A brief author biography and school overview will be included at the conclusion of each article.

For further information: Questions can be directed to the editors. The editors welcome suggestions from IALS members concerning ways in which the *IALS Journal* may be improved.