

STEM Summer Program Impacts Middle Schoolers, Pre-service Teachers

**Lori Goodson
Todd Goodson
Kansas State University**

**Lacee Sell
Manhattan-Ogden USD 383**

Abstract

A partnership between a local school district and a university's education college has created an innovative program that provides learning opportunities at all levels each summer. Entering its eighth year, the program brings together middle school students, pre-service teachers, classroom teachers, and university graduate students and faculty for a month of hands-on learning in a variety of STEM (Science, Technology, Engineering, Math) activities. The program continues to thrive with approximately 50 pre-service teachers, 325-350 middle schoolers, and 20-30 classroom teachers participating. Through the years, it continues to be an engaging and positive experience for those involved.

Sometimes great ideas are born by chance...a solution presents itself out of necessity in a simple conversation, only to build upon its successes through the years. Such is the case with a Kansas education college's long-standing Professional Development School (PDS) partnership with a local school district for its STEM Summer Institute (SI).

Seven years ago, the school district wanted to provide a summer camp-like program that focused on STEM (Science, Technology, Engineering, and Math) for the community's middle schoolers. However, the school district didn't have an air-conditioned facility available to house the classes during a hot Kansas summer due to construction projects at the schools. The college's administrators, noting that their building on campus was under-utilized during the summer, offered the space as an in-kind

[TABLE of CONTENTS](#)

consideration for prior summer staff development the district had hosted for university faculty. That first summer then served as a basis for a major Department of Defense grant the district received to support the work of the STEM SI camp in future years.

That was the summer of 2011, when 169 sixth- through ninth-grade students attended a variety of classes in the education building, led by 20 school district faculty and staff, and 39 pre-service college students and staff. Today, nearly eight years later, the STEM SI has developed into a signature program of the partnership with enrollment climbing to approximately 325 to 350 middle schoolers each summer.

The Summer STEM Camp is a product of nearly three decades of a formal PDS partnership with our local district. The project combines two key elements that have contributed to its success through the years—highly engaging STEM-related hands-on classes for the middle schoolers and field experiences loaded with authentic student-contact time for the pre-service teachers.

STEM INSTITUTE ATTENDANCE						
	5th	6th	7th	8th	9th	TOTAL
2016	126	93	62	28	13	322
2015	120	110	60	46	13	349
2014	110	95	62	35	13	315
2013	n/a	90	69	26	6	191
2012	n/a	93	56	31	11	191
2011	n/a	76	49	33	11	161

The Program

The STEM SI is held each summer during the month of June, running from 8:30 a.m. to 11:30 a.m. Monday through Thursday during the four weeks. School buses drop off the majority of middle school students who attend the summer institute, while others either ride their bicycles or are brought

to campus by parents. The students attend a class for four days, then move to another class for each of the next three weeks. An effort is made to keep the classes small, at a maximum of 15 to 18 students, to provide more individualized learning.

Table 1

2017 STEM Classes	Grade Level
3D printing	7-8
Bio Engineering	5-6
City of Minecraft	7-8
CSI	5-6
Exploring Drones	7-8
Fill Your Toolbox	7-8
Grain Science	7-8
Hollywood Science	5-6
Intro to Passive Architecture	7-8
M. U. S. I. C.	5-6
Maker Spaces	5-6
Mighty Micro Controllers	7-8
Monster Storms	5-6
Robotic Design	7-8
Robotics at STARBASE	5-6
Roller Coasters	5-6
Science of Sports	5-6
Simulating The Martian	5-6
Solar Construction	5-6
Thinking Through Games	5-6
Treasure Hunters	5-6
Vet Med	5-6
Writing into the Vast Beyond	7-8

The camp is offered in conjunction with the elementary and secondary undergraduate Core Teaching Skills course, so pre-service teachers participate in the delivery of the content and facilitation of activities for the middle school students.

This is an alternative field experience to the more typical placements in K-12 classrooms employed by the Core Teaching Skills course during fall and spring semesters. Those traditional field experiences usually involve pre-service teachers spending a specific number of hours in a classroom, getting involved in teaching a mini-lesson or two during that time. In 1997, the university began its secondary PDS program, with interdisciplinary teams of pre-service students making two visits to a

classroom; during the second visit, they presented a micro-teach lesson. The interdisciplinary teams never enjoyed widespread support from the college's students, so seven years ago the college began providing specific placements for them in pairs in classrooms that were specific to their disciplines. Meanwhile, the elementary version of the course required no field experiences because those were done further along in their coursework.

Approximately a year and a half ago, the elementary and secondary Core Teaching Skills courses merged, with an optional field experience offered during that initial semester. The course then shifted from requiring traditional field experiences to more of a service learning approach, with the university students serving in a variety of roles in the building other than leading a classroom—supervising bus duty, serving as reading buddies, etc.—other roles that teachers are expected to fill. Today, the traditional field experiences require approximately 20-25 hours in the classroom. However, the STEM SI involves 55 to 60 hours of direct work with the middle school students.

While initially it wasn't expected, our data suggest much higher student satisfaction with the summer field experience. The end-of-course surveys collected for fall, spring, and summer semesters document that students are much more satisfied with the summer field experiences. This has led to a rich conversation about the nature and purpose of initial field experiences for teacher education candidates.

The Benefits

The summer STEM camp initially addressed two concerns. For the college, it provided a way for students taking the Core Teaching Skills class during the summer to have a field experience when traditional classroom placements were not available. The expectation was that this summer

experience might not be as robust as the traditional fall/spring experiences, but any experience working with public school students would be better than nothing. For the school district, the goal was to provide a summer enrichment activity for the community, one that could engage middle school students in STEM in an attempt to encourage more STEM participation in the regular academic year.

For both institutions, the results have far surpassed the initial expectations. The structure and nature of the summer STEM camp has caused the college to re-think the nature of undergraduate field experiences, and the school district has asked serious questions about how the vitality and enthusiasm of the summer camp might be re-created during the academic year.

The benefits are not just for our pre-service teachers but also for all the other participants—the K-12 teachers and administrators who staff the camp, the college faculty, the university as a whole, the community, and over 2000 middle school students who have participated in our camp.

It's difficult to determine which group benefits the most from the SI—the middle schoolers or the pre-service teachers. Both groups have been extremely positive about the project.

Middle Schoolers

While the benefits of taking engaging STEM-related classes during the summer obviously are intended to encourage their success in future STEM classes during the regular academic years. Another goal of the project is to introduce them to STEM-related careers. However, these students also get an extended experience on the campus of a land-grant major university; many comment that they had not had any previous experiences on the campus despite having lived in the city for some time. They are taught by talented teachers from the school district, but are also assisted by the pre-service teachers. This connection with current college students provides the middle schoolers with some

unofficial mentoring regarding the opportunity to pursue a college degree—whether it be at the partnership college or at another institution.

Pre-Service Teachers

Formal practicum experiences in K-12 schools have become a staple of teacher education programs, such as those offered at the university during the fall and spring semesters. Reflecting on their teacher preparation experience, practicing teachers typically place more value on their formal student teaching experience (e.g., Levine, 2006) than other elements of their training. In terms of national priorities, American education has established formal, structured, and rigorous field experiences as the foundation of teacher education particularly given emerging research detailing positive impacts of field experiences on the growth of new teachers (e.g., NCATE 2011).

While a series of field experiences working with K-12 students arranged in a logical sequence with increasing levels of interaction and responsibility throughout a teacher preparation program has become an accepted goal, it is important to make the distinction between the student teaching experience (including extended or year-long residency programs) and field experiences connected to earlier courses devoted to pedagogy. A somewhat smaller body of research examines the latter (e.g., Carrier, 2011; Mills and Satterthwait, 2000), and this limited body of research typically assumes the location of a field placement will be a K-12 school site. Early field experiences (e.g., those before student teaching) in alternative sites and contexts such as that provided by our STEM camp is an area not typically considered in the existing research.

It is tempting to assume a practicum experience in a traditional class in a K-12 building during the academic school year would have more value than an alternative site and situation, but we do not

have the research base to support that claim. On the contrary, we could just as easily identify aspects of learning to teach that might be better addressed with novices in alternative sites.

In many ways, our Summer STEM Camp has characteristics of the lab school model, with K-12 students in residence on a college campus, providing opportunities for pre-service teachers to practice instructional skills. The STEM theme is popular in terms of a current emphasis on improving American STEM education (National Academy of Engineering and National Research Council, 2009), and community based learning experiences have shown potential for helping pre-service teachers develop deeper understandings of students from different backgrounds (e.g., McDonald, Tyson, Brayko, Bowman, Delpont, and Shimomura, 2011).

Our Partnership

We have evidence to suggest our summer STEM camp has some impact in terms of transforming the practice of our partner school district. The use of high-interest thematic sessions with a focus on student engagement and enthusiasm serves as a model for the K-12 teachers and administrators who staff the summer camp, and some efforts have been made to bring the excitement of the summer to the work of the academic year.

On an individual basis, the school district's teachers often find the summer program invigorating as they take the role of teacher for the middle schoolers and the undergraduates in a setting that emphasizes hands-on, creative learning with no state assessments awaiting.

The Community

Community participation has shown dramatic growth each year as demonstrated by the number of student participants, but it continues to gain more community support in other areas. More

colleges around the university are volunteering to join the program, and in Summer 2017 the STEM SI had its first private business provide expertise in leading a class.

The Potential

The camp provides a connection for our campus to our community, but it also provides a site for clinical practice for our undergraduate pre-service students. In terms of other field experiences that comprise clinical practice, we argue this project is clearly innovative, as all the actors in the event are forced into unfamiliar roles and/or contexts. Middle school students function in their familiar peer groups in the unfamiliar context of a major university campus. Middle school teachers work with their familiar middle school students in unfamiliar college buildings and facilities, with university faculty and undergraduate students observing and participating. Undergraduate students are in the familiar territory of their campus, working with the unfamiliar middle school students. Finally, university faculty across campus have a full month of the unfamiliar sight of busses rolling through campus, discharging hundreds of early adolescents who, by their very existence, will problematize the normally peaceful existence of campus in June. When so many groups are asked to do the things they normally do well in fundamentally different ways, innovation is certain. The contributions of the summer camp to both institutions have been profound and lasting.

Our goal is to share a powerful model, our innovative summer STEM camp. Participating pre-service teachers find camp participation a more robust field experience than our traditional placements in classrooms during the academic year, and the connections created among the PDS partners, the entire university, and the community are invaluable.

Future Research

TABLE of CONTENTS

The camp provides a connection for our campus to our community, but it also provides a site for clinical practice for our undergraduate pre-service teacher candidates. When compared with other field experiences that comprise clinical practice, this project is clearly innovative, as everyone is forced into unfamiliar roles and/or contexts.

Middle school students function in their familiar peer groups in the unfamiliar context of a major university campus. Middle school teachers work with their familiar middle school students in unfamiliar college buildings and facilities, with university faculty and undergraduate students observing and participating. Undergraduate students are in the familiar territory of their campus, working with the unfamiliar middle school students. Finally, university faculty across campus have a full month of the unfamiliar sight of busses rolling through campus, discharging hundreds of early adolescents who, by their very existence, will transform the normally peaceful environment of campus in June. All of these provide opportunities for research and reflection on education.

This program also is triggering a general discussion of the nature of field experiences for pre-service teachers. We have clear and convincing evidence that our students find the summer camp to be a more effective site for a field experience than our more typical placements in classrooms during the academic year. We believe this is a rich topic for discussion. Why is this environment so successful in terms of providing a site for novice teachers' first experiences presenting lessons to K-12 students? The answer to this question can provide important insights into how we can structure more traditional placements to better meet the needs of pre-service teachers, while also addressing the needs of our community.

Works Cited

- Carrier, S. (2011). Implementing and integrating effective teaching strategies including features of lesson study in an elementary science methods course. *The Teacher Educator*, 46(2), 145-160.
- Levine, A. (2006). Educating school teachers. *Education Schools Project*.
- Mills, Martin & Satterthwait, Donna. (2000). The Disciplining of Pre-service Teachers: Reflections on the teaching of reflective teaching. *Asia-Pacific Journal of Teacher Education*. 28. 10.1080/135986600109426.
- National Council for Accreditation of Teacher Education (2011). Transforming teacher education through clinical practice: A national strategy to prepare effective teachers. Washington, DC. <https://files.eric.ed.gov/fulltext/ED512807.pdf>
- NAE and NRC (National Research Council). 2009. Engineering in K–12 Education: Understanding the Status and Improving the Prospects. L. Katehi, G. Pearson, and M. Feder, eds. Washington, D.C.: The National Academies Press.
- McDonald, M., Tyson, K., Brayko, K., Bowman, M., Delport, J., Shimomura, F. (2011). Innovation and impact in teacher education: Community-based organizations as field placements for preservice teachers. *Teachers College Record* 113(8), 1668-1700.